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[OFFICIAL NOTICE.]

The Thirty-First Annual Meeting of the New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY,
NEW BEDFORD, MASS., Jan. 8, 1901.

The thirty-first annual meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, Mass., February 19th and 20th, 1901.

N. W. GIFFORD, Secretary.

BRIEFLY TOLD.

ADVANTAGE IN TRADING.—Last week the owners in the Consolidated Gas Company, of New York, met in annual assembly. The meeting was harmonious, of course. The gentlemen who control its fortunes, who seem to think that money banked is very useful, were all on hand. The only change that was made in the directorate was the substituting of Mr. Tilford for Mr. Auchincloss. Mr. Tilford and Mr. Sage formerly worked together, in the administration of the affairs of the Standard Gas Light Company, of the city of New York. Under our present point of view, Mr. Sage seems to be out of it practically; in fact, we fear his idea of business affairs is not longer of much moment. Still, he has done so much for the amelioration of his superiors in business! If he had taken time to remember that others would like to live, how much better would have been the gilding of his last, or later, days. Apart from whether Sloan, or Rockefeller, or Stillman, of the living, or Taylor, or Lake, or Hoyt, of the dead, control the fortunes of the Consolidated Gas Company, the plain fact remains that, between the living and the dead, the Company's real property and its ability to earn returns on that which it owns and distributes is not surpassed by any other company in America—not even the celebrated concern known as the Standard Oil Company. Certainly, the Consolidated Gas Company has not given much to its stockholders in ordinary, but the extraordinary ones have had all that was coming to them; and in whatever disposition is to be made of the profits at the end we hope those who own Consolidated gas will be able to hang on; for, at the annual meeting of the Company last week, President Gawtrey admitted that the sales of gas by the Company during 1900 exceeded those of the same Company during 1899 by something like 13 per cent. It must amuse Mr. Gawtrey to look back to 1879 when he was working with the people who disturbed the equanimity of the man who first presided over the fortunes of the Consolidated Gas Company. Life, though, is life; but when one is dead reputation sounds. The practical lesson from this is that trading in gas in this section of New York has been profitable, and that it will remain so, chiefly from the efforts of the men who build the works and run them, rather than from the peculiarities of those who "write" the stocks and sell them.

"ENGINEERING CHEMISTRY," BY THOS. B. STILLMAN, M. SC., PH.D.—The study of this book was started in an attitude distinctly hostile. It ended with a sense of satisfaction that we had read it and that we can use it; for it appeals from its lines to the American, as well as to the English, French or German, or other engineers. Taken as a

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whole the book is intended for the general engineer, not the gas specialist; yet the gas specialist finds so much of interest to him in it that he will surely believe "this man is a gas man." Its contents from the standpoint of the gas works manager may be divided into three parts of immediate interest, including the discussion of gases, chemically and commercially, the discussion of the raw materials for gas making and fuel—about one third of the book—that of mediate interests, including the chemistry of boiler waters, lubricating oils and other matter, say a fifth, and that whose interest is remote, as cements and the like, a tenth, leaving only about one-third whose interest may be called outside. And yet there is a possibility that at any minute much which seems remote or even foreign may be vitally needful information. This amount of specially interesting material in a book confessedly general in its plan is worth while. Although the field covered is very wide, yet it is well covered. No discussion is exhaustive; far from it. And nowhere has the author followed the example of men less competent by giving his conclusion under pretence of fact, with one single exception, and that an unimportant one. The writer gives his opinion as just what it is—his opinion, the result of his study—and without an exception he gives the references by which the student can form his own opinion, be it that of the author or one opposed. Many writers seem to fancy that text books are the place in which they may best air new notions, secure from criticism or contradiction. Not so Prof. Stillman. He has made his book emphatically one of reference to which the young man may safely go, feeling secure that what he finds has stood the test of time and hostile criticism. The book, however, is no compilation from approved sources. This is not to be imagined, for the personality of the author through his life's work is written large on every page. One can see his experience as a teacher in the explicit directions given for tests and experiments; his laborious work as a student in the bird's eye views of analytical operations embodied in the tables is shown. The first table to command attention is an admirable one on blast furnace slag analysis. It chances that, to save time, such a table was compiled for use by the writer when employed in coal analysis, and Prof. Stillman's is certainly the better. There are 15 of these labor saving schemes, and these alone, if backed by the needed experience, will make easy analysis which the chemical engineer particularly dislikes because of the demand on his time required to "Look up the Scheme." The discussion of gas analysis contains nothing new, and the more exacting methods are not even alluded to; the analysis discussed is the technical scheme as elaborated by Winkler, Hempel, Orsat and Elliott, using water as a confining fluid. This is really a serious omission, because the book is not one which could justly ignore the more accurate method by fixed volume. This is a small matter, however, since the more exacting analysis will be made, not by the engineer, but by the technical chemist; and his choice of method will be guided by another conception of the needs of the case. The book also contains much matter in regard to manufacture which is valuable and important; the description of methods in especial. Taken as a whole the chapter on gas analysis is not as good as one would expect from the rest of the book, but the tables and discussion of the analysis of raw materials are much better. The discussion of the analysis of coal, both from the standpoints of the furnace and of the oven, is very full, and contains an enormous amount of information. The chapter on oils is very full and reads as if Prof. Stillman had been recently reading his "Allen" when he wrote it. The chapter on calorimetry also shows familiarity with the most recent publications. From some of the conclusions recently published he seems to dissent strongly. It is plain that he is much impressed with the work of Prof. V. B. Lewes, for he reckons one entire group in the gas analysis as acetylene, which it most certainly is not. This is the unimportant slip referred to. Taken all in all the book will fill a place which has long been waiting to be filled on the shelf of the gas engineer, and will probably be found useful by many others. The art of the bookmaker does not shine however. The binding is not by any means what the contents merit, and the leaves in the copy before us are very irregularly placed, numbers being cut through only half the fold. Personally we like to cut the leaves of our books; but when we are reading a book we do not like to find a few leaves here and there uncut. The type is so beautifully clear and sharp that the inferiority of the paper and the binding is accentuated. The Chemical Publishing Company, of Easton, Pa., is the Publisher.

NOTES.—Mr. George L. Dunbar has been appointed Superintendent of the Fond du Lac (Wis.) Street Railway and Light Company, vice Mr. H. G. Johnson, resigned.——The wings of the Citizens Gas Light Company, of Bridgeport, Conn., seem to have been clipped to no purpose. At any rate, Mr. Burdett Loomis's relatives appear to be willing to sell out all their belongings to the Bridgeport Gas Light Company at the latter's price. The South is the place for Mr. Loomis.——The Gillette-Herzog Manufacturing Company is to furnish the steel work for the office building to be erected by the Surety Investment Company, on Curtis street, East Denver, Col.

The Duff Gas Producer and Ammonia Recovery Plant.

The gas producer and ammonia recovery plant herewith illustrated was designed by Mr. Edward J. Duff, M. Inst. C. E., and constructed by him at the works of the United Alkali Company, Limited, Widnes, England. This plant has been in successful operation for nearly 2 years, during which time, as our informant states, it has worked continuously with an entire absence of breakdowns, stoppages, explosions, or any other trouble, the gas only being turned off during the annual shut down of the works for cleaning operations. There is not a "spare" producer, each producer working at full load the whole year without any stoppage whatever. Any kind of ordinary slack can be gasified in this producer. Lancashire and Yorkshire slacks have been used chiefly, containing 10 per cent. to 20 per cent. of ashes, some of them being of a very bituminous caking nature, and containing a large proportion of fine dust. The yield of ammonia, as sulphate, varies from 85 pounds to 100 pounds per ton of coal, according to the quality and kind of fuel used.

The apparatus is one of the simplest yet devised for the production of power gas and the recovery of ammonia. The gas producer used is similar to Mr. Duff's 1893 design—several hundreds of which are in successful operation in many countries. It consists of a square chamber lined by a thick wall of firebrick. Across the center, at the base of the producer, inclined gratings with stoking gear distribute the air and steam evenly across the whole area of the fuel bed, blowing from the center of the fire outwards toward the lining. In this way no free air can escape up the linings, as in the case of outside blown producers; consequently there is no risk of the gas above the fuel bed being burned into carbonic acid. The linings are also preserved, as there is not an excess of air to cause a too active combustion at that point; the shell is thereby kept cool and radiation reduced to a minimum.

Fig. 1 is a front view of the plant, and Fig. 2 an end view. In Fig

Fig. 1.

1 the coal elevator will be seen at the left hand side, the coal being delivered into a conveyor passing over the top of the producer, and delivering into storage feed hoppers over the center of each producer. The large rectangular chambers, seen in Figs. 1 and 2, immediately behind the producers, are the superheaters and dust separators. Between these and the tower scrubbers are placed the scrubbers for washing and cooling the gas. At the left of Fig. 2 the towers will be seen in perspective; the nearest one is the ammonia recovery tower, the second is the gas cooling tower, and the third the air heating tower.

The gases pass from the producer through the superheater and dust separator; here the outgoing gas is partly cooled by the ingoing air and steam. The gas then passes through a scrubber, and is further freed from dust and tar before it enters the ammonia recovery tower, where the gas is scrubbed with a weak solution of acid liquor, which absorbs the ammonia. The gas passes from the top of this tower directly into the top of the gas cooling tower which forms its own

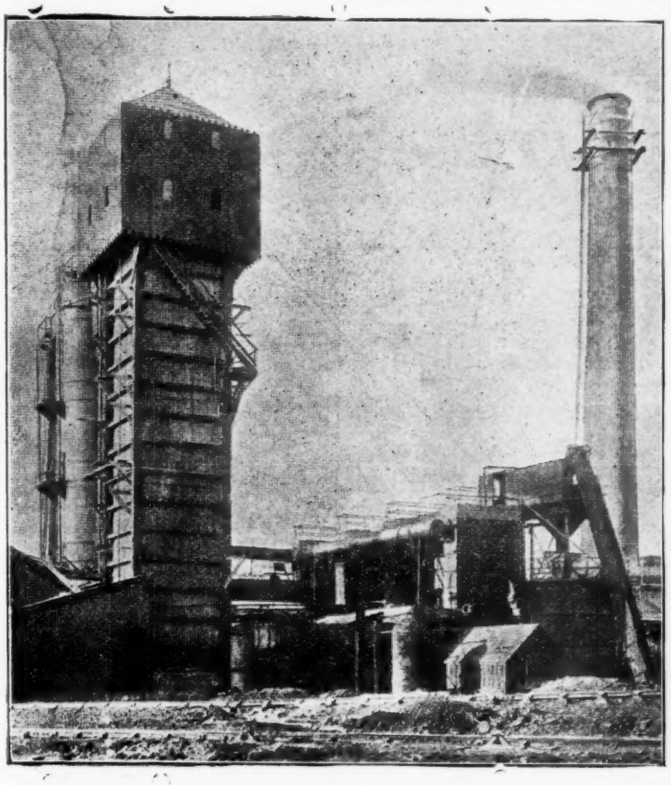


Fig. 2.

downcomer; the gas passes out of the lower portion of this tower ready for use. The water used to cool the gas rises up inside the gas cooler, and then flows down through the air heater, or third tower, and becomes cooled for use over again in the gas cooler. It will be noticed that there is an absence of downcomer gas tubing from the tops of both gas towers, and also, that there are not any rising water mains from the pumps to the top of the towers. In this case the gas cooler is so arranged that it not only forms its own gas downcomer, but its own rising main for the water also. As this water flows over the top of the gas cooler and down the air heater, it follows that one pumping of the water only is required as against two pumpings in older processes, while the heat losses from gas downcomers and hot water rising mains are altogether avoided, and a greater efficiency of recuperation is thereby obtained.

Mr. Duff has, at present, under construction for an important firm a plant consisting of ten such gas producers, with ammonia recovery plant, capable of gasifying 1,400 to 1,500 tons of coal per week. The gas will be used in metallurgical operations, as well as in large gas engines.

This plant will be the largest of its kind in existence, and will be capable of producing gas equal to nearly 20,000-horse power. Mr. Duff is also engaged upon the design of a large central power gas plant for an important industrial English center, the power to be transformed into electrical energy, and used on a large scale in manufacturing establishments, as well as for private and municipal purposes.

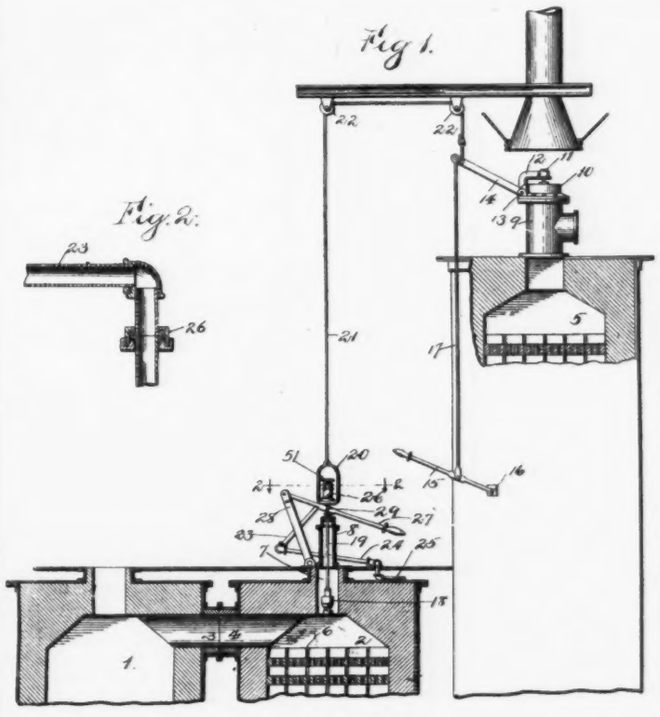
Johnston's Gas Apparatus.

On December 18th, 1900, U. S. Letters Patent (No. 664, 855) were granted to Mr. John P. Johnston, of Oak Park, Ills., for certain new and useful improvements in gas apparatus. A part of the rights was subsequently assigned to Mr. E. E. Morrell, of Oak Park. Using the words of the Johnston specification, the inventor says:

My invention relates to apparatus used in the manufacture of water gas. In gas apparatus of this character it is usual to supply the oil to the carburetter through feeding or spraying devices arranged in a carburetting chamber, and consequently subjected to the heat thereof, the result being that the oil feeding apparatus is soon burned out and has to be replaced. This, I have discovered, can be avoided by providing for automatically withdrawing the oil feeding devices from the carburetting chamber when they are not in use. This I accomplish as hereinafter described and as illustrated in the accompanying drawings, and what I regard as new will be set forth in the claims.

In the accompanying drawings, Figure 1 is a sectional view of the upper part of a generator, a carburetter and a superheater, illustrating my invention; and Fig. 2 is an enlarged view, being a partial sectional view on line 2 2 of Fig. 1.

Referring to the drawings, 1 indicates a gas generator; 2 a carburetter communicating therewith by registering passages 3 4, extending from the generator and carburetter, respectively, and 5 a superheater; 6 indicates the usual checker brick in the carburetting chamber; 7 indicates a passage extending upward from the top of the carburetting chamber, and 8 a tube which rises from the passage 7 and communicates therewith; 9 indicates a stack, which rises from the top of the superheater and communicates with the superheating chamber; 10 indicates a cap or valve, which is adapted to close the stack 9. The valve 10 is pivoted on a spindle 11, carried by a crank arm 12, which is carried by a horizontal shaft 13, pivoted in suitable bearings at the top of the stack, the arrangement being such that by rocking the shaft 13 the valve 10 can be raised or lowered, so as to open or close the stack; 14 indicates a lever, which is connected to the shaft 13 for operating the same; 15 indicates a hand lever, which is pivoted to a suitable support 16, and is connected by a connecting rod 17 with the lever 14, so that the operator by grasping the lever 15 can operate the lever 14 and raise or lower the valve 10 to open or close the stack 9; 18 indicates the oil feeding device,



which in the construction illustrated is adapted to be supported in the passage 7, as shown in Fig. 1; 19 indicates a tube, which supports the oil feeder 18 and rises through the open end of the tube 8. The upper end of the tube 19 is secured by a bracket 20, or other suitable device, and a flexible chain or cable 21 to the lever 14, the cable passing around pulleys 22, as shown in Fig. 1. By this construction, when the lever 14 is in its uppermost position, the valve 10 will lie over and close the stack 9 and at the same the oil feeder 18 will be in its lowermost or operative position. When the operator moves the lever 15 down to raise the valve 10 and open the stack, the same operation will raise the oil feeder 18, drawing it out of the carburetting chamber and removing it largely from the heat thereof. It will thus be seen that the oil feeder is subjected to the intense heat of the carburetter only when it is in use, and consequently its life is greatly prolonged. In order to supply oil to the feeder 18 regardless of its position, jointed pipes 23 24 are provided, which communicate with an oil supply pipe 25, and with the upper end of the tube 19, an angle valve 26 being provided at the upper end of the tube 19 to permit of the movement of the pipe 23.

Under certain circumstances, such as the breaking down of the automatic mechanism, it may be desirable to raise the oil feeder by hand, and for this purpose a lever 27 is provided, which is pivoted at one end upon a swinging link 28, suitably supported at the top of the carburetter,

said lever being connected to the upper end of the tube 19 by a pivot 29, as shown in Fig. 1.

While the oil feeding apparatus is illustrated as being movable in a vertical plane into and out of the carburetting chamber, it may be arranged in other positions and used for analogous purposes without materially changing the arrangement of the automatic devices for controlling its position. My invention, therefore, includes such alterations and modifications as would occur to those familiar with the art and is not limited to the specific devices or arrangement illustrated and described, except in so far as such features are specifically claimed.

The claims of the inventor are :

1. The combination of a heating chamber, a stack therefor, a valve for said stack, a gas chamber, a feeding device adjustable in said gas chamber, and means operated by the movement of the stack valve for adjusting the position of said feeding device.

2. The combination of a heating chamber, a stack therefor, a valve for said stack, a gas chamber, a feeding device movable into and out of said gas chamber, and means operated by the movement of the stack valve for moving said feeding device into and out of said gas chamber.

3. The combination of a gas chamber, a feeding device movable into and out of said chamber, a superheater, a stack therefor, a valve for said stack, a lever for operating said valve, and a connecting device connecting said lever and feeding device and so adjusted that when the valve is operated to open the stack the feeding device is automatically moved out of the gas chamber.

4. The combination of a gas chamber, a feeding device movable into and out of said chamber, a superheater, a stack therefor, a valve for said stack, a lever for operating said valve, a connecting device connecting said lever and feeding device and so adjusted that when the valve is operated to open the stack the feeding device is automatically moved out of the gas chamber, and a hand lever for moving said feeding device out of said gas chamber.

The Design of Steam Power Plants.—No. VII.—Condensers.[1]

[By Mr. Henry C. Meyer, Jr , in *Engineering Record.*]

The purpose of attaching a condenser to a steam engine is to remove part of the pressure of the atmosphere, by creating a partial vacuum, from one side of the piston, and thus increasing the pressure acting upon the other side. If an engine is running without a condenser, with a mean effective pressure of 40 pounds, and a condenser is added removing 12 pounds from the back pressure caused by the pressure of the atmosphere, the mean effective pressure would be increased, theoretically, to 52 pounds, and the power would be correspondingly increased. If, however, the work done remains the same, the increased mean effective pressure, 52 pounds, can be reduced to 40 pounds by cutting off the steam earlier in the stroke and thus save steam nearly in the proportion that the cut-off is reduced. A condenser can, therefore, either increase the capacity of an engine, or it will reduce its steam consumption per horse power if the load and other conditions remain the same. If an engine is operated non condensing with the most economical load for it and a condenser be fitted to the engine, this same load will no longer be the most economical one, although the steam consumption per horse power per hour will probably be considerably less with the condenser than without it. A condensing engine should have a larger cylinder than a non condensing engine to do the same work, if both are to run with the lowest possible steam consumption per horse power. The method of determining proper cylinder dimensions for engines running condensing and non-condensing was given in Chapter IV.

A condenser provides means for bringing cool water into contact with exhaust steam or for cooling by water thin tubes around which the exhaust steam passes, so that the latter is condensed. A vacuum is formed in the condenser by reason of this condensation, and thus part of the pressure of the atmosphere is removed. Because of the small volume occupied by the condensed steam relative to its volume as steam at the same temperature, the condensed steam or water may be removed from the condenser by a comparatively small pump using a small amount of steam to operate it. This pump also removes such air as may be in the exhaust steam, hence it is usually called an air pump, although it serves to remove the water as well.

Saving due to Condensers.—Generally speaking, a condensing engine will use from 75 to 80 per cent. of the steam required by a non-condensing engine. Power, however, is required to drive the air pump, and this saving is, therefore, not a clear gain. The steam required to drive an independent steam driven air pump is from 1 to 4 per cent. of that used by the main engine, depending on the size of the latter. This use of steam for driving the air pump need not necessitate a loss, if the exhaust steam from the pump is used to warm the feed water before the latter is delivered into the boilers. If the feed water is drawn from the air pump discharge or if it is fresh water heated in a feed water heater placed in the exhaust pipe between the engine and condenser, 110° F. is about as high a feed temperature as can be obtained on account of the vacuum in the condenser and the correspondingly low temperature of the exhaust steam. It is, therefore, advantageous to use the steam exhausted by the air pump for feed water heating in an auxiliary heater, so called because it receives the exhaust steam of the auxiliaries of the plant, such as the air and boiler feed pumps. This heater is sometimes called a secondary heater when a primary heater is placed in the exhaust pipe of the engine. By means of the auxiliary heater the feed water may be raised from 110° to about 170° in a large well proportioned plant, and to a greater extent in smaller plants, as the steam required for the air pump and boiler feed pump becomes a greater proportion of that used by the main engine. If the feed water is drawn from a city supply or reservoir and is not passed through a heater in the exhaust pipe of an engine, the exhaust from an air pump and boiler feed pump will raise it through about the same number of degrees of temperature that it would if the feed water was at a temperature of 110°.

With a non-condensing engine the feed water may be heated by the exhaust steam in a feed water heater to within 5° or 10° of the temperature of the team or to about 205° or 210° with steam at atmospheric pressure; consequently, with condensing engines, the saving in coal used by the main engine due to a condenser over the use of the same engine running non-condensing is partly counterbalanced by the higher feed temperature that may be secured when running non condensing. With feed water taken from the condenser discharge at a temperature of 110°, there would be a saving, with a steam pressure of 100 pounds, of about 9 per cent. if the feed water could be further raised in temperature to about 210°, as it probably could be if the engine was run non condensing. However, by using the exhaust steam from the air and boiler feed pumps of a condensing plant to warm the feed water taken from the air pump discharge, there will be such a small difference between the final feed temperatures in the two types of plants that the slight difference can be neglected in considering the saving due to the use of a condenser. It is impossible, and perhaps unnecessary, to figure the exact saving due to a condenser, but, generally speaking, it may be taken at about 20 per cent., hence plants are almost always fitted with these auxiliaries when condensing water is to be had, and the exhaust steam is not needed for heating or for some manufacturing purpose. When an abundant supply of condensing water is not at hand, steam plant owners often go to considerable expense for artificial cooling devices, so great is the economy in using condensers.

Types of Condensers.—Condensers may be divided into three general types, known as the jet, the surface and the siphon condensers. The jet and surface condensers require an air pump, and each of these may be again divided into direct driven or independent condensers, the former when their air pumps are driven by the main engine either by being directly connected to it or connected by a belt. The independent condensers are usually driven by steam cylinders forming part of their equipment. Condensers with air pumps driven directly from the main engine have been almost abandoned for stationary engines, the satisfactory manner in which the design of independent condensers has been perfected and their superiority over the direct driven condenser having brought this about. The greatest advantage of the independent air pump is its greater flexibility, it being possible to change the speed of the separately driven type without regard to the speed of the main engine, so that it can be run to suit any condition of load.

The jet condenser consists of a pear shaped chamber, at the top of which the exhaust steam enters, while at one side is a connection for the injection or condensing water. The bottom of the chamber has a contracted neck connecting with an air pump which is sometimes very similar to the ordinary direct acting steam pump, or it may be an air pump of special design. A cross section of the Worthington jet condenser with horizontal double acting air pump is shown in Fig. 23.

The surface condenser consists of a shell, usually of cast iron, containing a large number of brass or copper pipes through which the condensing water is circulated, the exhaust steam being admitted to the shell in the space surrounding the pipes. The steam coming in

1. *Ante.* Vol. LXIII , p. 929, Dec. 10, 1900.

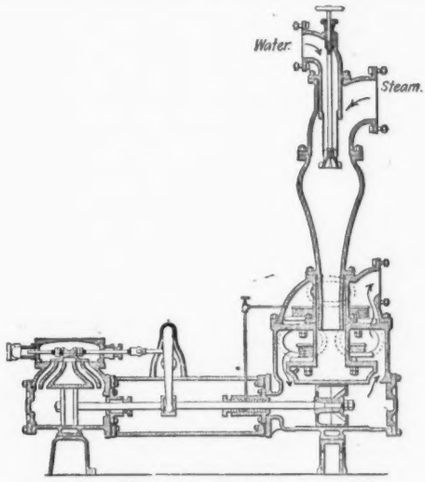


Fig. 23.—Jet Condenser.

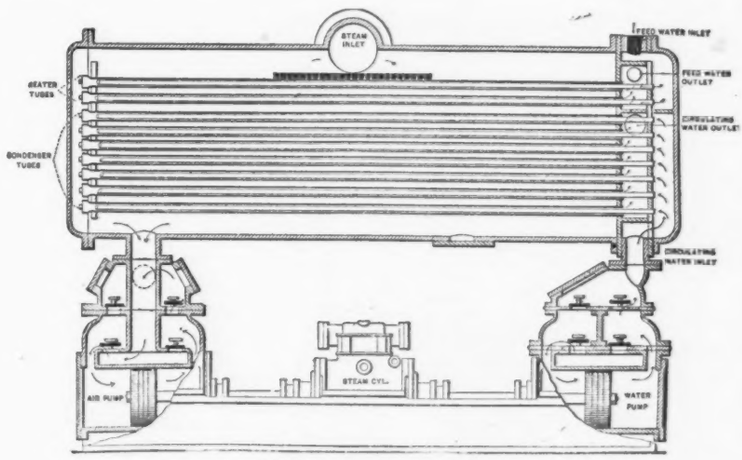


Fig. 24.—Surface Condenser.

contact with the cooled pipes is condensed, and the condenser is so connected with the air pump that the condensed steam flows by gravity to the air pump, by which it is removed to maintain the vacuum. If the cooling water is under pressure no pump is necessary to circulate it through the vacuum. If not, a circulating pump is required and this may be driven by the same steam cylinder that operates the air pump. It is usually the practice to place the air and circulating pump and the steam cylinder operating them in line, tandem, beneath the condenser and on a base supporting the whole.

An arrangement of this kind showing the Wheeler method of mounting a surface condenser on the cylinders of a Knowles' air and circulating pump is shown in Fig. 24. Circulating water is sometimes supplied by centrifugal pumps driven by an engine or electric motor. As the condensed steam does not come in contact with the circulating water in the surface condenser, this type can be used when the circulating water is of such a character that it should not be fed to the boilers. The condensed steam is used over again until it becomes so impregnated with cylinder oil from the engine that it has to be replaced by fresh water. The presence of cylinder oil in feed water causes trouble in steam boilers, and it is the fear of this trouble from oil that prevents the wider adoption of the surface condenser in power plants. However, by providing proper filters of sand, cloth, sponges, excelsior or similar material for the feed water and properly looking after them there is no reason why the surface condenser cannot be used with success.

The Bulkley siphon condenser, which in a general way is similar to others of this type, is shown in Fig. 25. The steam from the engine is led in a pipe to the top of the condenser, which is elevated sufficiently to be placed about 34 feet above the surface of a hot well into which the condenser discharges. The injection water enters at the side and mingles with the steam at the lower edge of the cone shown. By contracting the neck of the condenser below the cone, sufficient velocity is given the water in falling to the hot well to maintain a siphon like action that draws the steam from the exhaust pipe, and causes a vacuum to exist in it. The injection water can be supplied by a pump of either the steam driven or the centrifugal type. If the injection water can be had under sufficient pressure, the pump is not necessary. This type of condenser will lift water from a source of supply, such as a tank or reservoir, through a height of 18 feet or less, but with this arrangement the siphon must be started. This can be done by running a horizontal pipe from the reservoir or tank across to a tee in the vertical discharge pipe of the condenser. Water flowing through this and down the discharge will gradually exhaust the air from the upper part of the discharge pipe until sufficient vacuum is formed to draw the water up to the condenser and start the water flowing through it. When this is done a valve in the cross connection or starting pipe is closed.

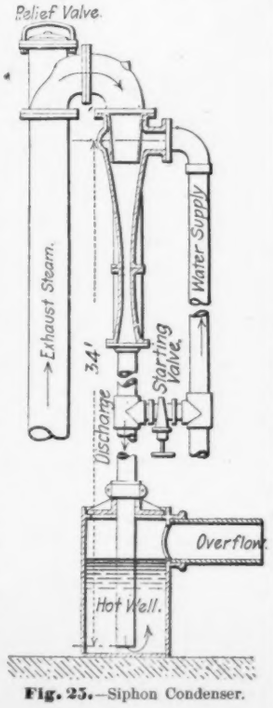


Fig. 25.—Siphon Condenser.

Fig. 26 shows an elevation of the Worthington central jet condenser which is a modification of the siphon type. It is called the central system because it is often used to condense the steam of more than 1 engine. An enlarged cross section of upper part is shown in Fig. 27. The condensing cone is considerably larger than in other siphon condensers, the idea being that the steam and water are more thoroughly mixed, thus using less water. The spray is controlled by an adjustable nozzle. The neck of the condenser is not contracted, as it is in the ordinary siphon condenser, to give the high velocity to the descending water necessary to suck the air down into the discharge or tail pipe. The contracted neck was avoided to give the water an unrestricted fall so that it could not by any chance back up in the condenser and run over into the exhaust pipe. To assist in removing the air from the condenser cone an air pipe, shown in Fig. 27, is led to a dry vacuum pump, which constantly removes air from this pipe and very considerably increases the vacuum over what would be obtained without it. The air cooler shown in the drawing is used to cool the air while it passes from the condenser cone to the vacuum pump, the air passing through tubes in the cooler around which the injection water is circulated. By cooling this air its volume is reduced, hence the vacuum pump has less work to do.

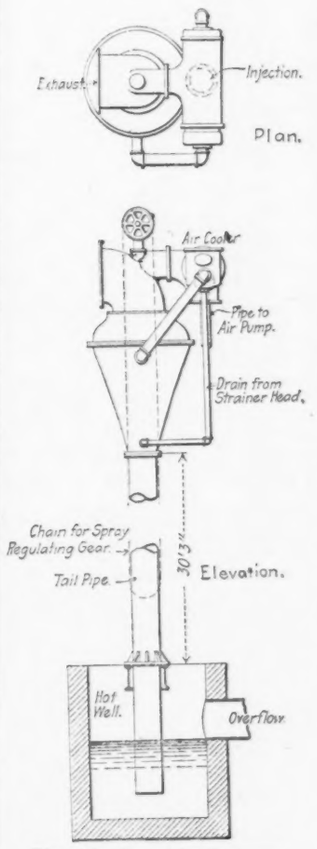


Fig. 26.—Central Jet Condenser.

Location of Condensers.—It is necessary to locate a condenser of the jet or surface type on a lower level than the engine, so that the pipe connecting the engine and condenser will be either perfectly horizontal or pitch slightly toward the condenser. This is necessary to prevent the existence of a pocket where water can collect in the pipe line. As this pipe is under a vacuum, water, due to condensation, that collects in it cannot be drawn off by a trap. If a pocket does exist, there is chance, in the event of broken vacuum, of this water getting back into the cylinder and wrecking it. One occasionally sees a condenser located on the floor with an engine. When this is done the exhaust pipe from the engine drops from the bottom of the cylinder, then runs horizontally, then rises to the condenser, thus forming a pocket, to which objection has been raised ; this arrangement should

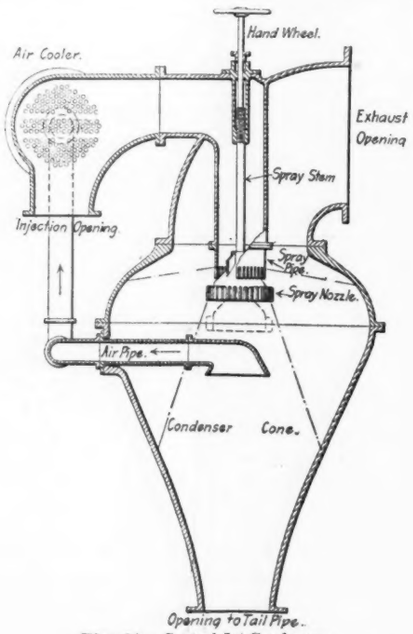


Fig. 27.—Central Jet Condenser.

be avoided. There being a vacuum in the condenser, the injecting water can be lifted from a reservoir or pound at a lower level. It is not advisable to lift water through a greater head than 20 feet, including the actual vertical distance the water is raised and also the friction of the water in the injection or suction pipe. A condenser is sometimes located in a pit considerably below the engine in order that the lift may not be too great. As stated in the first chapter of this series, the availability of a supply of condensing water often determines the location of the power house. If a river or reservoir is nearby and it is not desirable to locate the power house close to the river, water can be led to a well close to the condenser either in an open trench or in a tunnel or conduit and the injection pipe run to the well. This would overcome the use of a long injection pipe. If the injection pipe is run underground it should not be covered over with earth until after the condenser is started and the pipe tested for air leaks. One of the most frequent causes of trouble with a condenser is a leaky suction pipe, hence the greatest care should be used to make sure that it is perfectly tight. General methods of connecting condensers with engines were given in the chapter on "Steam Piping."

Water Necessary for Condensers.—A considerable amount of water must be available if a condenser be used, and to calculate this, one must first find the weight of water necessary to condense each pound of exhaust steam and then determine the amount necessary to condense all the steam exhausted by the engine. This is found by dividing the rise in temperature that takes place in water used to condense the steam into the heat contained in 1 pound of steam at the pressure at which the exhaust valve in the engine begins to open less the heat in 1 pound of water at the temperature of the air pump discharge. Expressed algebraically, this equation is: $W = (H - h) \div (T - t)$; in which H is the total heat in steam at the terminal pressure, h is the heat in water at the temperature of the air pump discharge; T is the temperature of the discharge condensing water, and t is the temperature of the entering condensing water. The value of H for different pressures and temperatures may be formed in tables giving the properties of saturated steam, and may usually be taken at 1,150. Taking average values for a surface condenser with h at 120, T at 110, and t at 70, then W will be found to have a value of about 26 pounds per hour. If a jet condenser is used the condensed steam and air pump discharge would have the same value. When the same water is used over and over again to condense with, as is done with cooling towers or cooling reservoirs, the temperature of the condensing water is quite high when it enters the condenser, so that each pound can absorb a comparatively small amount of heat and a correspondingly greater volume of condensing water is required.

In estimating the quantity of injection water necessary due consideration should be given the amount of steam exhausted by the engine during maximum load; also the increase in the steam consumption of the engine per horse power that will occur when the engine has been in service for some time, due to the leakage of valves and piston on account of wear. The writer believes in being liberal in selecting condensers for a good vacuum particularly with engines operating with low mean effective pressures, is conducive to high economy. Some engineers hold that a high vacuum is a mistake, one of the reasons being that with it the temperature of the condenser discharge is lower and consequently the feed water will not be so hot. There is, however, a loss due to reducing the mean effective pressure acting on the engine piston that considerably more than offsets such a gain. By a decrease in the vacuum from 26 to 24 inches it would be impossible to increase the feed water temperature more than 15°, and this would mean a saving of a little more than 1 per cent. This decrease in vacuum in a compound engine, with 125 pounds steam pressure, most economically loaded, would effect, theoretically, an increase in the steam used of about 5 or 6 per cent., and with a simple engine about 2.5 per cent. It will be noticed on investigating duty trials of large pumping engines where high duty is desired that a very high vacuum is sought by the builder.

Sources of Water Supply for Condensers.—Water for condensing purposes may be obtained from rivers, in which event the water goes to waste after it is discharged from the condensers, or from ponds or artificial reservoirs. When drawn from ponds or artificial reservoirs the source of supply has to have sufficient volume and surface so that it will be cooled naturally by the air. If the reservoir is too small for this it must be cooled artificially by some method that exposes the water sufficiently to the air to cool it, as in the cooling tower. Reservoirs where the cooling is done naturally require surface sufficiently large to allow enough water to come in contact with the air to remove the necessary amount of heat from it, and they should also have sufficient volume, if they are used continuously, so that the water can remain in the reservoir long enough to be cooled before being used again. Cooling reservoirs of this kind are rendered much more efficient by dividing them by partition walls so that the water is compelled to travel some distance in passing from the condenser discharge to the intake where it is drawn from the reservoir to return it to the condenser. This is to prevent the discharge from the reservoir from immediately entering the intake before it has time to cool.

There is very little reliable information on the surface and volume required in cooling reservoirs. Thomas Box, in his work on "Heat," says that when an engine works day and night the depth of the reservoir is unimportant, and that 210 square feet of surface is required per horse power. When an engine runs only 12 hours per day the surface may be reduced to 105 square feet per horse power, but in the latter case the depth of the reservoir must be such as to give 300 cubic feet per horse power. Box assumes the use of 1 cubic foot of 62½ pounds of water evaporated into steam per horse power. These data are based on experiments when the water was reduced in temperature from 122° F. to 82°, the air being at a temperature of 52° and the humidity 85 per cent.

Cooling Towers.—These appliances provide means for artificially cooling condensing water, and their successful development has made it possible to obtain the benefit of a condenser in many plants where condensers would be out of the question without them. Usually they consist of large cylinders of boiler steel open at the top and inclosing either mats or tiles or some similar substance presenting a large surface over which the hot water from the condensers is allowed to trickle downward, from distributing pipes at the top. The water falls into a reservoir at the bottom, from which it is returned to the condenser. An opening or openings in the side of the tower allow the air to enter and pass up through it, thus cooling the water. Usually a fan driven by an electric motor or small steam engine is used to stimulate this current of air. A cooling tower can be located almost anywhere outside of a power house, on the ground or on the roof. There is a loss of water attending their use of from 10 to 15 per cent. of that passing through them, owing to the evaporation that occurs. Where cooling towers are located at a higher elevation than the engine, the condensing water must be pumped from the condenser to the tower, but the power required to do this is, with surface condensers, mostly counterbalanced by the fall of water from the reservoir at the base of the tower to the condenser. The column of water in the condenser discharge pipe for the height of the tower itself is, of course, unbalanced.

Proportioning Condensers.—In the jet type of condenser the air pump has to remove from the condenser the injection water, the steam that is condensed, and a certain amount of air that finds its way into the exhaust steam either from the boiler or through leaks in the pipe, condenser, etc. This last is a very uncertain quantity. With a surface condenser the cooling water does not come into contact with the steam, hence the air pump has to remove only the condensed steam and the air. To determine the size of the air pump for a jet condenser, the amount of injection water in pounds per minute necessary to condense

the steam exhausted by the engine should be calculated in the manner previously described, and this reduced to cubic inches per minute. This quantity should then be doubled, if the air pump is to be of the horizontal double-acting type—to allow for the air, and the number of cubic inches thus obtained should be about equivalent to the volume in cubic inches that should be displaced by the air pump piston in 1 minute. This latter quantity, the displacement, is equal to product of the area of piston in square inches, the number of double strokes per minute and the length of stroke in inches.

With vertical single acting air pumps the product of the area of the cylinder in square inches and the length of stroke in inches and the number of single strokes per minute, should be 50 per cent. greater than the volume of injection water in cubic inches per minute. The size of air pump necessary to do a given work can be determined with the data given, from the catalogue of condenser manufacturers. These give the area of cylinders, length of stroke and maximum number of strokes that the condenser should run per minute.

With surface condensers, the air pump displacement should be 20 times the volume of steam condensed, with horizontal double acting air pumps, and 15 times the volume of steam condensed with vertical single acting air pumps. Surface condensers usually have 1 square foot of surface in brass or copper tubes for every 10 pounds of steam to be condensed per minute.

Specifications for Condensers.—Generally in purchasing jet condensers, an engineer states the horse power and type of engine for which a condenser is wanted, but it is better perhaps, if the engineer is sure of himself, to give the number of pounds of steam that must be condensed in a given time, and the vacuum that is desired. This is usually 26 inches. If the engineer has calculated the volume of the air pump cylinder, bids on condensers with air pumps of approximately this volume can be obtained. His specifications should also call for a blue print or drawing showing the condenser the builder intends to supply, and on this blue print should be given the outside dimensions of the condenser, the size of the steam cylinder, the diameter of steam and exhaust pipe opening, the injection or suction pipe and the discharge pipe. The delivery and erection of the condenser should be provided for, if the builder is to deliver and install it.

A specification for a surface condenser with combined air and circulating pump should ask for a print of the apparatus, the size of the air, water and steam cylinders, the size of the steam and exhaust pipes, etc., also the square feet of heating surface in the condenser proper.

Guarantees.—Sometimes a condenser manufacturer is required to guarantee its efficiency, but this is not often done. The form of guarantee that is fairest to the condenser manufacturer would be, perhaps, to ask that the apparatus should condense a given amount of steam delivered to it at a certain pressure, and maintain a given vacuum, usually 26 inches, with a given temperature of cooling water. The location at which the vacuum is to be obtained should be stated, for frequently there is considerable drop in pressure between the exhaust pipe next to the engine and the condenser owing to a too long or too small exhaust pipe. The vacuum ought to be measured close to the condenser, for the maker of the latter is not responsible for the selection of the exhaust pipe. He may not be responsible for the size and run of the injection pipe leading cold water to the condenser, or for the lift of water in it, and as these very materially affect the efficiency of the condenser, the manufacturer should have the opportunity, if a guarantee is made, to approve the details, size and arrangement of the injection pipes. These remarks apply also to jet and siphon condensers. With a surface condenser and combined air and circulating pumps, the only guarantee that should be asked is maintaining a specified vacuum with a specified temperature of cooling water. The manufacturer would have to satisfy himself with the arrangement of the water piping that it was proposed to use. If a complete cooling tower and condensing outfit was to be supplied the guarantee should state the vacuum that is to be obtained with a given temperature of outside air, and when that air contains a certain percentage of moisture.

[To be Continued.]

AT the annual meeting of the Delaware County Gas Company, of Chester, Pa., the officers chosen were: Directors, W. S. McManus, Richard Wetherill, Geo. B. Lindsay, O. B. Dickinson and Richmond L. Jones; President, W. S. McManus; Vice-President, Richard Wetherill; Secretary and Treasurer, L. A. Tucker; Superintendent, J. M. Callanan.

The New Century.—Looking Forward.

By MR. THOMAS NEWBIGGING, in *Gas World.*

In the previous articles we have endeavored succinctly to review the progress of gas enterprise from its inception down to the present time. The story is an interesting one, and not less so by reason of the prosperous condition of gas undertakings to-day.

The impression stamped upon one's mind on a consideration of all the circumstances must surely be that a vast amount of energy and ability were brought to bear on the industry by the men, both in the earlier and later days, who devoted their time and talents to its furtherance.

There have not been wanting critics, honest, doubtless, but misguided, who, any time within the last 20 years, have been ready to predict the decay of the gas industry. We need not be over censorious in referring to these pessimistic opinions. Looked at from their own superficial standpoint, the critics in question had some reason for holding the views they expressed. It is not given to every man to be a philosopher—to hold the balance with a steady hand and weigh the probabilities for and against. Besides, in order to form a correct opinion, a knowledge of all the circumstances was necessary, not only of the industry in itself, but also of the steady determination and enthusiasm which actuated those responsible for its continued success. On the advent of the practical application of the electric light, in the later seventies and earlier eighties, a wave of depression broke over the minds of gas stockholders, and led many of them to do what they have had reason to regret ever since—to part with their holdings at a sacrifice. To-day there is not an owner of gas property who does not look upon his gas stock as amongst the safest and most remunerative of his possessions. And he has substantial ground for this view.

Some Proofs of Stability.—Proofs of stability in gas enterprise are not lacking. Let us consider some of these proofs.

(1) The Stock Exchange estimate of value. Gas debentures cannot be purchased to yield, on the average, more than 3¼ per cent., preference stock 3½ per cent., and ordinary stock 4½ per cent.—this notwithstanding the recent inflation in coal prices. Fluctuations, less or more, in the market prices of the shares or stocks in all industrial concerns are inevitable. They are influenced by the current value of money, by the cost of materials and labor, the general state of trade, and the quality of the administration in each particular case. It is a fact, however, that the price of gas stock and shares is less liable to variation from these causes than any other shares or stock of an industrial character. This is due in a large measure to the circumstance that buyers are more plentiful than sellers, than which there can be no better criterion of public confidence; such confidence being based on the view, which is indisputable, that gas is a necessity of life to the great bulk of our population. It may, indeed, be asserted that, Consols excepted, there is no steadier investment than the shares or stock of a well managed gas company.

(2) The assertion that gas has become a necessity of life to many, receives abundant corroboration in the growing desire on the part of local authorities for possession; and this, too, notwithstanding the remarkable appreciation that has taken place in the value of gas undertakings within the last 20 years. In the lighting of streets and roads under the control of local authorities gas has outdistanced its chief competitor, electricity, both in efficiency and economy. This is admitted without stint by the most eminent of the electricians themselves.

(3) The residual products of gas manufacture have become indispensable to the carrying on of many other important industries. Even if the tar and ammoniacal liquor could be otherwise provided, it would be at an enhanced cost, and the industries concerned would suffer by the loss of one of the main and most economical arteries of supply. Clearly, this is a cause of stability of which account must be taken.

(4) Nothing in gas enterprise is more remarkable than the rise of the vast industries, employing a multitude of workers, that have been called into existence during the last quarter of the century in the production of apparatus for the utilization of gas for cooking, heating, and motive power. Busy brains are at work in the perfecting of this apparatus, and in devising extensions of the use of gas, by means of suitable appliances, to numerous minor industries in all parts of the kingdom.

The indirect result of this is, of course, to reduce the smoke nuisance and mitigate the fog demon in our cities and towns.

(5) Admitted that gas does not now hold the field of artificial illumination without a rival, as in the first three quarters of the century,

the room for expansion in the directions above indicated is almost illimitable. But even as an illuminator for domestic use, gas more than holds its own. Both oil and acetylene are out of the running where coal gas can be obtained, and even electricity must yield the palm as regards economy and illuminating value. Thanks to the genius of Welsbach, a new era for gas lighting has been inaugurated; and, what must not be overlooked as a striking feature of the invention, the higher lighting results of his system are obtained with greater economy in gas consumption. The man who has increased our artificial light three-fold, with, at the same time, a saving in expenditure, is surely only second as a benefactor of his kind to the other who has made two blades of grass grow where only one grew before.

(6) Notwithstanding competition by other illuminants, the consumption of gas throughout the country has doubled in the last 17 years. This is at the compound rate of 4¼ per cent. per annum.

Such are some of the proofs of the stability of the art of gas manufacture. Look where we may over the wide field of gas enterprise there is life and vigor and progress.

But what of the exhaustion of our home coal supply? What of the gas industry then? To that we will only answer (and it is a sufficient answer) by saying that, whenever our coal supply fails, or shows evident signs of failing, it will be a bad day for other British industries besides that of gas.

Work Yet to be Done.—With all these remarkable signs of prosperity, does nothing remain to be done? Yes; certainly! There is no such thing as finality. There is no end or limit to progress in any art. Progress is as infinite as space, of which, indeed, it is the counterpart.

It is not only a new year, but a new century that has dawned upon us. What gifts has the twentieth century in store for the gas profession? Only such gifts as the members of the profession *will* for themselves and their art. No more; no less!

On one occasion, in speaking of the scope that exists for adding to our knowledge of coal distillation, with all its intricate changes in decomposition and synthesis, I advised our young and aspiring managers to get into the retorts when at work. I repeat that advice to day. It is only by projecting brains into the seething and glowing mass of coal in the retort that the secrets of distillation are to be wrested from it. The same process applied to the purifying apparatus, beginning with condensation, and following the gas through to and beyond the lime and oxide vessels, would yield important results.

Looked at from every point of view, the field of gas enterprise is still as wide and as capable of fruit yielding as a Western prairie with its virgin soil, one corner only of which has been brought under cultivation. There are rich crops awaiting the cunning hand of the husbandman, and they will spring to life at the touch of the coming genius.

Pointing the Way.—By way of supplement to what has been advanced, and to indicate in what directions progression may be looked for in the immediate future, it may be pointed out that only about one third of the ammonia to be obtained from the coal is secured by our present processes. The late Professor Foster was devoting attention to this question when his career, unhappily, was cut short by death. The subject is well worth pursuing to day.

It appears to us that important developments in carbonization are attainable—one can almost discern their coming. This has been borne in upon us after listening to the suggestive lecture recently delivered to the members of the Institution of Gas Engineers by Professor Lewes.

The inclined system of retort settings, with its labor saving and other advantages, will grow in favor year by year. The obvious drawback to its wider and more immediate adoption is the impossibility of applying it in retort houses under existing conditions, and the heavy capital cost of remodelling these latter to admit of its application.

Gas engineers might profitably consider the question of so modifying their retort firing arrangements as to allow of the system being applied in houses the walls of which range, say, from 26 to 30 feet in height One direction in which such modification might be sought is in the method of heating the retorts. This could be accomplished by erecting one or more large producer furnaces in a building immediately adjacent to the retort house, the combustible gases being conveyed therefrom to the retorts by means of a main laid underground, with branches to the different benches, somewhat after the method adopted by Mr. Carpenter of the South Metropolitan Gas Company to his horizontal settings. By so doing, the clinkering cellar would be dispensed with and the retorts could be set slightly lower on their bed. The coal bunkers or hoppers for feeding the charging apparatus would extend wholly or partially through the roof, and a special small roof could be erected over them to protect the coal from being drenched by rain or snow. An experiment of this kind might well be made, and with every prospect of success.

Continuous purification in closed vessels is yet an unsolved problem. Our present methods are so cumbrous and unsatisfactory—not so much as regards efficient purification as in the direction of scientific method and economy of labor—as to encourage the belief that a better system will yet be evolved. The production and extraction of the cyanide compounds should receive attention in all the larger gas works.

Indications are not wanting that a system of high pressure distribution might be attempted, if not throughout the entire canalization of a district, at least through the trunk or leading mains. If this could be attained without increased loss of gas there would be a distinct saving of capital, by obviating the periodical enlargement of the main pipes and the consequent breaking up of the streets.

The Requirements of the Customer.—It is a remarkable fact that in the conduct of no other industrial concerns in the commerial world is the customer so completely ignored as in the administration of a gas undertaking. This arises, doubtless, from the reason that the supply of gas within a district is a practical monopoly. There are exceptions, as we know, to this state of things, but they are rare. We have no hesitation in asserting that managers neglect an important as well as a most interesting part of their duties in allowing their customers to act solely on their own initative in the use of gas, whether in lighting, heating, or motive power. The obtrusive and dictatorial spirit must, of course, be guarded against; but constant opportunities for advice and guidance will present themselves to the manager jealous for his own reputation and that of the undertaking he has in charge. Other directions in which progress and improvement may be introduced will suggest themselves to the thoughtful gas manager.

An Opportunity for Distinction.—Finally (and here I speak to a wider constituency), it is much to be desired, on the score of economy, and in respect also of efficiency, that the system of devolution were applied to legislation on gas and other local matters. The cost of promoting and opposing bills in Parliament often entails a heavy burden on a provincial concern. The necessity of frequent journeys to Westminster, with sometimes quite an army of witnesses, is a grievous source of expense. This cost might be saved under a system of inquiry conducted by a committee, say of three members of the county council, whose decision could be embodied in an Act of Parliament. The subject is worthy of attention and study by an aspiring member of Parliament in want of a fitting subject on which to build an enduring reputation.

Telegraph Operators in the Philippines.

[By Mr. F. E. Grain, in *Elec. World.*]

A most pressing need for telegraph operators has existed in Luzon, Panay, Cebu, Negros, Mindanao, Gimeras and other of the leading islands of the Philippine Archipelago, where Goverment lines have been put in recently. The linemen have been putting in new lines much faster than the operators can be furnished to supply the stations. Very many of the stations which were fitted up with a view of permament occupancy have already been abandoned because of lack of telegraph operators. The Government is constantly sending over new men, but not fast enough to meet the requirements, for hardly a day passes that a new station is not opened in some part of the archipelago. Within a very few months the work of connecting all of the islands by cable will begin. The United States cable ship *Burnside* has a considerable portion of this cable aboard, and, with Manila as a center, the cable lines will extend to the most remote points in the Philippine group. At the present time the only islands joined by the cable system are Panay, Cebu and Leyte, which are wired with Luzon. The establisment of the new connections so as to connect all of the numerous islands of the Philippine Archipelago will necessarily call for the employment of additional stations, and of course a telegraph operator in each station, and in some cases, where there is much night work, there must be two operators. The advent of the cable lines also means that there will be additional stations established in the interior of the different islands. At present the island of Luzon is well provided with stations and the interior can be reached at any time. Panay Island is also liberally dotted with telegraph stations, and the movements of the troops can be known at all times to the department commander. Still there is a severe handicap due to shortage of men on both of these islands. The writer recently met the telegraph operator of San Jauquin, one of the coast stations, going into Iloilo, where he had been ordered to report to take charge of the office at

Jaro. There was no other way to get a man for the Jaro station than to close np the San Jauquin station. I stopped over at Tigbauan one night and found the operator ill wlth fever, and his superior officers were trying hard to get a man to take his place so as to "relieve" him and permit him to go to the hospital. But none could be had for several days, and, the Tigbauan station being a central point, several branches depending upon it for transmission of messages by telegraph or telephone, the office could not be closed and the ill operator stuck to his post until finally a man was secured by closing up an office of minor importance.

The Government is sadly in need of experienced operators, and when the new cable lines are established the need will be greater than it is at present. There are now, to the knowledge of your correspondent, a number of important offices closed simply for lack of men. One of the reasons why many men do not enlist for this service is that the pay does not seem to them to be as much as it ought to be.

The pay is indeed low, but it must be remembered that the Government provides everything, including rations, lodging, medical attendance, clothing, etc. The pay of a first-class private in the signal corps is $20 40 per month. Many operators enter the service in this capacity, although some are not thoroughly qualified and are obliged to enlist as second-class privates, in which case the pay is a little lower. After a short service, however, the second-class private is usually appointed a first-class private. In a year or so he becomes a corporal, with a slight increase in pay and privileges. In course of time he may become a sergeant, in which case his pay begins to jump upward, and if he passes through the stages to chief operator he will find that he is drawing a salary of $40 to $50 per month, and nearly all clear gain.

The writer has been here about a year in the field and has met with many operators direct from home, most of whom are glad to get the outing offered as a change from the confinement of office work in their former occupation. Often the new man arrives and instead of being put directly into an office he is ordered to join the linemen, in which case he usually finds that he has some rough soldiering to do. All his work is performed with a rifle slung to his back or a revolver in his waist belt, ready to drop and take shelter and open fire upon any enemy in the brush. Linemen are particularly distasteful to the rebels of the islands, and they take every opportunity they can to harass the little bands of workers who are stringing wires across the newly garrisoned country. Ordinarily a guard of from 6 to 8 men accompany the linemen, in which case there is not so much danger of molestation.

There are periods of the year in the group during which the heavy gales sweep the islands from shore to shore, carrying everything before them. I have witnessed the disastrous effects of several of these gales. Shortly after the gale begins, the operators, linemen and all prepare to make repairs. As soon as the gale shows signs of abating, the operators and the linemen secure the services of dozens of natives and then the work of replacing broken poles and repairing insulators and wires begins, so that in a day or two the lines are once again in operation. Often the enemy take advantage of the gales to do further damage to the lines. If natives are caught near the lines by soldiers or linemen the orders are to shoot any who are acting suspiciously or have tools in their hands for cutting wires. But when the gales rage the native can readily sneak up to the lines and help the gales in their work of destruction by tearing down weakened poles and breaking insulators with rocks, so that the extent of the destruction is sometimes very great and the loss heavy, for the reason that supplies of cross-arms and insulators are not in abundance here, although poles can be cut from the forests readily.

Applicants for appointment to the signal corps of the army in the Philippines must be physically sound. I have seen many good men rejected from some defect of the eyes or lungs. Even before the applicants are put through the test examinations in the United States concerning their knowledge of line work, telegraph operating, signalling, etc., they are examined physically. This is a severe climate on most men, and few can escape the ravages of one or more of the numerous fevers of the islands. There appear to be fever microbes in the air, for the men never drink any but boiled water, and every precaution is taken to prevent fevers. Yet I have seen many of the men stretched out day after day on the floor or ground of their tents suffering from fever. Often the fever hangs on for many days and will not cease until the man is sent to the hospital for an ice bath. The ice bath drives the fever out of his system and puts him on his feet for a few months, when he is likely to get another touch. Series of such fevers bring on typhoid. But it may be two years or more before anything of the sort occurs, and before the two years have expired the man is usually relieved and sent to a station in the United States. It is believed that definite plans have now been made so that the men will have to serve only 18 months in the Phillippines, when they will be relieved and permitted to serve a year in the United States before again returning to the islands.

But it is not only telegraph operators that are in great need by the Government for Philippine service. Electrical sergeants are in very great demand. The Government is sending to American firms for considerable electrical apparatus, and electrical sergeants are required to set it up and see that some one is instructed to operate the machine. The Government will put in electrical apparatus on the same lines as in the forts in America. The principal electrical apparatus will be in the line of lighting.

The Government has an electrical training department for electrical sergeants at Fort Monroe, Va., but in the present emergency and need of men, competent electricians are taken direct into the service and assigned to duty in the Philippines. The Government is planning to put in permanent barracks in about a hundred different places in the islands, and in nearly all of these electric apparatus of some sort is to be put into service for lighting and for other purposes, pretty much after the plans of the barracks in the United States. Arrangements have been made for sanitary engineers to put in the proper piping, baths, closets, drainage systems, etc., and the barracks are evidently to be made clean and healthful and fitted with modern conveniences. In each of these barracks an electrical sergeant will be required to supervise the electrical devices and machinery in general, including probably the pumping machinery, the steam engine, the ice making plant and all that concerns the power and mechanical system of the station. It is a post of importance and trust. The sergeant, of course, would be given several helpers, some of whom would be soldiers, civilians and natives. As to the requirements of a man who can fill a position of this kind, they are quite numerous. The Government expects that the applicant has had at least two years' experience in an electrical shop of some sort, where he either manufactured electrical devices or operated them. The American manufacturers of electrical devices are sending to these islands the best and most modern patterns of machines, and the electrical sergeant undoubtedly would be the only man at some of the posts who would understand the machine. All would therefore depend upon him to get the machine running correctly. If he is a blunderer, the chances are that the entire equipment of the plant will constantly be at fault, while if he is a competent electrical engineer, the best of service may be expected.

Some of the electrical machines arriving here get pretty well smashed up and new parts have to be made; and the electrical sergeant must be capable of drawing new plans for the broken portion or to so repair the fractured parts as to make the piece suitable for service again. No help in this direction may be expected from the natives. They will do well enough to fire a boiler, cut wood, haul ashes, clean machinery, and do ordinary laboring work, but if you give one of them a broken piece of machinery to repair the chances are that he will wind the parts with thin split bamboo or tie them together with a piece of string.

One electrical sergeant I met here was formerly a fireman on a steam road, but he managed to pass the examination for the post of electrical sergeant through the good education he had received in a technical school. He knew all about the parts of machinery, their names and application, and therefore managed to deceive the examining board. But when he got here and had to go to work with the wrench and adjust armatures, reset commutators, repair the connections of brushes, etc., he found himself in a new field and was lost. He managed to pull through, however, by hiring a civilian electrician who happened to be here, to help him out.

The examining board is very careful about the selection of men that are naturally mechanical. They require that the applicant proceed with tools to take apart some machine and put it together again in their presence. If they see that he breaks off the side or the head of a screw with a screw driver, or that he tries to turn the screw the wrong way, the fact counts against him. If he barks his knuckles in turning off a nut, then it is concluded that he is not familiar with handling the wrench.

Book knowledge, that is, such as one gets by reading books on industrial, direct and alternating current electricity, construction use and care of dynamos, engines, belting, tools, etc., counts, however, for considerable with the examining board. Applicants who have been industrious enough to take one, two or three years' course of instruction from some electrical correspondence schools find that they are received well by the committee. Men who have taken an interest in visiting large electric light plants for the purpose of seeing how the works are

conducted, and have made notes of improvement and advantages, are also pleasing to the members of the board.

The Government desires men who are about 25 to 30 years of age for its electricians, it seems, for it does not appear to consider it worth while to take very young men who have not had the advantage of business or mechanical experience. Nor does it want very old men, for the reason that the work is by no means light in these tropical climates, and a man must be brisk and young to stand the hardships.

Electrical sergeants in the service here must be ready to shoulder the rifle whenever necessary, for often it is known that there is certain electrical apparatus of Spanish design in the possesion of the enemy at certain points, and it is desired to capture the plant. Then the electrical sergeant is taken along to oversee the removal of the equipment by means of bull carts and drag sleds. The apparatus is usually found in service for signalling on the beaches; the light, being very strong, is seen great distances, often from one island to another.

Our Manufacturing Supremacy.

By Mr. Jean Wetmore, in *Electricity*.

The foreign commerce of the United States owes its rapid development to a complex number of causes, but fundamentally to the higher average of intelligence among its producers, the result of free schools of a high order and a comprehensive postal system which brings the untrammeled products of the press into the most humble homes.

The United States Government has fostered the intelligence of the people, and their widened understanding and inventive genius have insured the creative power of the nation and given it prestige in international commercial competition.

Our workmen are above being dumb driven cattle; they are heroes in the strife, endowed with quickened mental faculties, which give skill and celerity of movement to their physical efforts. They direct the movements of machinery and through their intelligence they have practically graduated from manual drudgery. The latter has been growing constantly less through the ever increasing applications of still better mechanical aids.

The whole tendency of our growth is toward an increased output, of a better quality at a constantly decreasing cost price, and at the same time a gradual increase in the wages paid for the necessary superior quality of skill and knowledge required by the operators.

Improved machinery has made possible the well established fact that in many instances the lower the cost price of an article, the higher are the wages paid. Accurate, fast working machinery, with high-priced skilled attendance, has given us our commercial prestige. Our liberal patent laws have done much to encourage the inventive faculty among practical workmen, to yet further reduce the drudgery element and lower the cost of production.

As a result our productive capacity has gradually increased our wealth and consequently our available working capital, and to day we are witnessing the rapid development of an element that has heretofore claimed little attention—the immense segregation of capital and skill in each particular industry that makes possible still further reduction in the cost of manufacture through more systematic business methods and a better utilization of the waste or by-products. Many of our manufacturing establishments have receipts from the sale of prepared waste material that formerly cost considerable to dispose of, but which now equals the gross income from their staple products itself. These economies are possible only through the use of the most improved methods and a high grade of scientific skill which only large capital doing business on a grand scale can command. Many of our largest exports at the present time are of this class.

The first century of the Republic has been spent in getting ready to do business, by practising on a trade of a domestic character. The second century of our growth will consist in actually doing a foreign export business which will not be rivalled by any other nation. Much has thus been accomplished, but there is much yet to do. We are hampered by a diversity of languages, for which adequate preparations have not been given our young business men.

Our manufacturers have been protected and encouraged by wise laws to promote their rapid growth, but the same wisdom has not been shown in the direction of building up an international merchant marine.

Our commercial rating bureaus are unexcelled, but we have not as yet the same facilities in the foreign markets. We are troubled by official red tape in Russia and ignorance in Turkey and China. Our internal preparations have been adequate for a world wide commercial growth, while our preparations at the other end of the line have not received the attention they merit. We are even ridiculed for our ignorance in packing goods for foreign shipment.

We have the quality of goods the world desires and the prices to secure the trade but we have not at present the proper kind of foreign connection to give us the necessary advice and carry out our superior business methods.

These difficulties are only temporary and incident to our present stage of growth. The fundamental foundations of our commercial supremacy are substantially and wisely laid and the finished superstructure will be rapidly completed.

We have barred competition in our own markets by fostering the intelligence and the inventive genius of our individual workmen and protected our feeble industries until they are now able to make goods better and cheaper than their foreign rivals; our manufacturing trusts with their immense aggregation of capital and skill are now able to utilize every kind of waste product and through comprehensive systems of organization to save the cost of much useless labor, and turn it into productive channels, with the final result that the country now finds itself unable to consume its own products, owing to the great fecundity of its resources.

We now demand wider markets, and these are the reasons why the United States will eventually become during the second century of its existence the dominant and productive commercial power of the earth.

Electric Fire Risks.

Mr. Hubert S. Wynkoop, writing in *Cassier's Magazine*, on this subject, says:

In accordance with that law of compensation under which nature imposes upon us greater responsibilities in return for greater comforts, the employment of electricity for such domestic purposes as heating and lighting gives rise to more numerous chances of danger than accompany the use of gas or oil. This is not to be interpreted to mean that of the agents—whether oil, gas, or electricity—one is more dangerous intrinsically than another, but, rather, that popular unfamiliarity with the latest illuminant leads to a careless handling of electric appliances.

Everyone knows that the filling or the overturning of a lighted oil lamp may start a fire, sometimes preceded by an explosion; similarly, it is a matter of common information that the blowing out of a gas jet conduces to asphyxiation, and that searching for a gas leak with a lighted candle invites an explosion. Therefore, most people refrain from experimenting along these lines, though they may be guilty of outrageous practices in connection with electricity. Comparatively few of the great body of the public are familiar with even the simplest laws of electrical cause and effect; the knowledge of the many is limited to an ability to turn on or off an electric light by means of a key or switch, or to replace a burnt out lamp with a new one. Evidences of the general ignorance on this subject are everywhere apparent—nails and screws driven into electric light moulding, wires in contact with foreign metallic objects, fuses uncovered so that molten metal may fly about among easily ignitible material, and conductors so overloaded as to be perceptibly hot.

Some of these evils are due to faulty installation; others, to careless or ignorant handling during service. In the former case, ignorant or unscrupulous persons impose upon the householder, so that his wiring becomes a memorial to the contractor's dishonesty or incompetency; in the latter, the blame rests solely upon the householder himself.

That the situation is not worse is due primarily to the fire underwriters, who at an early date in electric lighting history realized the importance of restricting indiscriminate methods of construction, in order that the greatest possible immunity from fires might be secured. In the United States the present rules of the National Board of Fire Underwriters are the standard for electrical construction throughout the country, and work carried out strictly in accordance with their requirements is safe when subjected to reasonable care in subsequent handling. These rules have been developed duriug the past 20 years, and are still in process of evolution.

The electrical inspection performed by the underwriters, intelligent, honest, and painstaking though it be, is not in all respects satisfactory. It rests upon no provision of law, so that, if the construction prove faulty, the insurance companies have no way of compelling the removal of the menace other than by the purely moral methods of in-

creasing the premium or suspending the policy until alterations shall have been made. The inspector concerning himself with fire risks on policy covered property only, has no power, however, and but little inclination, to trespass upon uninsured premises for purposes of investigation. A fee is usually charged for inspection, and this burden, falling upon the insured, largely augments the premium in case of a small policy, and in any event encourages concealment of electric alterations or additions, because each notification which results in an inspection entails an additional expense upon the tenant. Furthermore, since the object of the underwriter's inspection is to secure reduced insurance risks, it follows logically that higher premiums permit of taking greater chances, and, consequently, different standards of construction are applied to different householders, according to the rates paid by them.

Several American cities have already instituted systematized electrical inspections and are obtaining satisfactory results from them. Indeed, Chicago has progressed so far that the underwriters themselves, it is stated, have for the past 5 or 6 years accepted the city certificates, making few or no inspections themselves; but Chicago is particularly fortunate in the possession of ample and explicit ordinances governing electrical appliances and providing penalties for violation of the rules. Custom differs in various localities as to the charging of fees for inspections; but whichever system be preferred, there can be hardly any doubt that a rigid electrical inspection should be undertaken, under due authority of law, in every community large enough to boast of a sanitary inspector or a fire marshal—if there be in the community any buildings lighted by electricity or served with electric power.

The argument has been frequently advanced that, inasmuch as the underwriters have more at stake than the city authorities, the former should be more worthy of confidence than the latter, and that the most good for the least money may be attained by legalizing the work of the insurance companies. The custom prevailing in a number of localities which requires independent inspections by the city, by the fire underwriters, and, frequently, by the operating companies as well, involves not only a waste of official energy, but unnecessary annoyance and delay to the occupant of the premises. It seems to the writer that the municipal inspection alone should be required before the appliances are placed in service. A more leisurely investigation of new work, with a view to checking the accuracy of the city inspections, and a periodic survey of old work—for which a large city finds but little opportunity—would then become the proper functions of the electrical bureaus of the underwriters.

While the operation of electrical appliances in buildings is fraught with many dangers if the installation be faulty or the maintenance in unintelligent hands, there is no reason why one should hesitate to avail himself of this modern agent of light, heat, and power. The standard rules governing this subject represent the experience gained through a systematic investigation of fires attributable to electric origin. Unfortunately, there are persons engaged in the wiring business who, either through wilful neglect or through ignorance, depart from the requirements laid down by experience, and it is physically impossible for any inspection department to watch work so carefully as to absolutely prevent the existence of defects. In the city of New York, for example, there are 1,200 or 1,500 electrical contractors, each of whom employs from 1 to 50 men; and, unless an inspector could be assigned permanently to each of these men, there would remain the possibility of some defects being overlooked. However, the moral effect of the inspection system tends to guarantee the excellence of material and workmanship, for the workman cannot predict what portion of the installation will receive the closest scrutiny, and he is, therefore, not likely to slur any portion of it.

While the last statement holds true generally, there are some exceptions, arising from two reasons. One is the complexity of the rules which makes some portions of them not easily understood, and which can be removed only by rearrangement. The other reason is a desire on the part of the contractor to undertake the cheapest construction permissible and a tendency to omit those details whose absence is likely to escape detection. To eliminate this evil, provision should be made for the imposition of a penalty to cover intentional neglect of the official requirements or failure to remedy defects within a reasonable time after the service of an appropriate notice upon the negligent person.

The passage of suitable laws providing for the licensing of electrical workers would prove an efficient deterrent to poor work. The plumbing trade is subject to such legal control, and the results attained are eminently satisfactory. A master plumber who knows that his license and his bond are at stake is greatly concerned as to the conscientiousness and ability displayed by his subordinates; and there appears to be no good reason for exempting electrical workmen from similar control.

Aside from the shock attendant upon the passage of electricity through the human body—a contingency rather remote and one resulting always from abnormal conditions or careless handling—the overheating of ignitible material is the one electrical danger to be apprehended. With electricity such heating may result from various causes. The amount of heat generated by the transmission of electrical energy depends, in general terms, upon the resistance encountered in the conducting medium, the quantity of current flowing, and the rapidity of heat radiation. For this reason a poorly constructed joint in wire laid in wooden moulding may, by interposing a high resistance, develop a local heat sufficient to char the woodwork, which eventually bursts into flame; or, a circuit designed for the supply of 16 candle power lamps, may be called upon to carry the same number of lamps of 32-candle power, thus doubling the flow of current and causing an increased heating effect throughout the entire length of wire; or, a wire designed for carrying a certain current when strung on insulators and exposed to the air, may be placed in wooden moulding, at the whim of the tenant, who cannot understand why a larger wire is required for the latter method because he does not stop to consider the decrease in the rate of heat radiation which results from the change. So, also, the presence of weak or defective insulation may cause a series of infinitesimal leaks from wire to wire, which, added together, assume finite proportions, and may result in adding to a circuit a burden entirely ignored in calculations of wire sizes.

To guard against this overheating the insertion of a "fuse" in the line is usually resorted to. This is a strip of metal of such material and cross section as to insure its melting—and thus opening the circuit—upon the passage of a current sufficient to barely overheat the wire. The fuse, however, is no protection against the heat developed at bad joints or at points where leakage from one wire to another (or to some other conducting medium) is localized. It prevents an excessive flow merely, not a flow along unauthorized paths or over improper obstructions.

And yet heavy copper or iron wire is not infrequently used to replace these fuses, thus defeating the object of the device; and, indeed, cases are on record where the brass-capped fuse plugs were filled solid with lead, in order, as the engineer expressed it, "to do away with the only weak part of the system!"

When a fuse "blows" it invariably scatters molten metal, which may communicate a dangerous degree of heat to the material upon which it falls; and yet very many people fail to understand why the inspector requires that the fusing appliance shall be inclosed in a non-combustible case.

The only protection against poor joints lies in the prevention of them.

The best protection against local leakage consists in the adoption of a good insulating covering for the wires and of such a method of construction as would permit of the operation of the circuits without leakage if the wires were entirely uncovered, in which case the insulation becomes an efficient factor of safety. The first general suggestion which appears in the rules of the National Board of Fire Underwriters of the United States reads as follows:

"In all electric work, conductors, however well insulated, should always be treated as bare, to the end that under no conditions existing, or likely to exist, can a grounding or short circuit occur, and so that all leakage from conductor to conductor, or between conductor and ground, may be reduced to a minimum."

"Grounding" is the development of a possible path from one wire to some foreign conducting medium, as, for example, a gas pipe or a metal ceiling; a "short circuit" is a path from one wire to another. Upon this fundamental suggestion by far the greater part of the rules of the above Board are based.

An acquaintance of the writer, practiced in the designing of appliances electrical, is fond of characterizing each invention as it comes out as "fool-proof;" and the dominant thought which guides his labors is to so construct his devices that the misuse of them entails more labor than does their proper operation. So it is with the electric wiring rules; they are intended to render the whole construction "fool-proof." Many a provision in them which seems altogether useless at first blush, has been inserted with a view to guarding against the repetition of accidents which have actually happened; and, if we accept the general intent of the rules, we must perforce agree to observe their detailed requirements.

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The argument has been frequently advanced that, inasmuch as the underwriters have more at stake than the city authorities, the former should be more worthy of confidence than the latter, and that the most good for the least money may be attained by legalizing the work of the insurance companies. The custom prevailing in a number of localities which requires independent inspections by the city, by the fire underwriters, and, frequently, by the operating companies as well, involves not only a waste of official energy, but unnecessary annoyance and delay to the occupant of the premises. It seems to the writer that the municipal inspection alone should be required before the appliances are placed in service. A more leisurely investigation of new work, with a view to checking the accuracy of the city inspections, and a periodic survey of old work—for which a large city finds but little opportunity—would then become the proper functions of the electrical bureaus of the underwriters.

While the operation of electrical appliances in buildings is fraught with many dangers if the installation be faulty or the maintenance in unintelligent hands, there is no reason why one should hesitate to avail himself of this modern agent of light, heat, and power. The standard rules governing this subject represent the experience gained through a systematic investigation of fires attributable to electric origin. Unfortunately, there are persons engaged in the wiring business who, either through wilful neglect or through ignorance, depart from the requirements laid down by experience, and it is physically impossible for any inspection department to watch work so carefully as to absolutely prevent the existence of defects. In the city of New York, for example, there are 1,200 or 1,500 electrical contractors, each of whom employs from 1 to 50 men; and, unless an inspector could be assigned permanently to each of these men, there would remain the possibility of some defects being overlooked. However, the moral effect of the inspection system tends to guarantee the excellence of material and workmanship, for the workman cannot predict what portion of the installation will receive the closest scrutiny, and he is, therefore, not likely to slur any portion of it.

While the last statement holds true generally, there are some exceptions, arising from two reasons. One is the complexity of the rules which makes some portions of them not easily understood, and which can be removed only by rearrangement. The other reason is a desire on the part of the contractor to undertake the cheapest construction permissible and a tendency to omit those details whose absence is likely to escape detection. To eliminate this evil, provision should be made for the imposition of a penalty to cover intentional neglect of the official requirements or failure to remedy defects within a reasonable time after the service of an appropriate notice upon the negligent person.

The passage of suitable laws providing for the licensing of electrical workers would prove an efficient deterrent to poor work. The plumbing trade is subject to such legal control, and the results attained are eminently satisfactory. A master plumber who knows that his license and his bond are at stake is greatly concerned as to the conscientiousness and ability displayed by his subordinates; and there appears to be no good reason for exempting electrical workmen from similar control.

Aside from the shock attendant upon the passage of electricity through the human body—a contingency rather remote and one resulting always from abnormal conditions or careless handling—the overheating of ignitible material is the one electrical danger to be apprehended. With electricity such heating may result from various causes. The amount of heat generated by the transmission of electrical energy depends, in general terms, upon the resistance encountered in the conducting medium, the quantity of current flowing, and the rapidity of heat radiation. For this reason a poorly constructed joint in wire laid in wooden moulding may, by interposing a high resistance, develop a local heat sufficient to char the woodwork, which eventually bursts into flame; or, a circuit designed for the supply of 16 candle power lamps, may be called upon to carry the same number of lamps of 32-candle power, thus doubling the flow of current and causing an increased heating effect throughout the entire length of wire; or, a wire designed for carrying a certain current when strung on insulators and exposed to the air, may be placed in wooden moulding, at the whim of the tenant, who cannot understand why a larger wire is required for the latter method because he does not stop to consider the decrease in the rate of heat radiation which results from the change. So, also, the presence of weak or defective insulation may cause a series of infinitesimal leaks from wire to wire, which, added together, assume finite proportions, and may result in adding to a circuit a burden entirely ignored in calculations of wire sizes.

To guard against this overheating the insertion of a "fuse" in the line is usually resorted to. This is a strip of metal of such material and cross section as to insure its melting—and thus opening the circuit—upon the passage of a current sufficient to barely overheat the wire. The fuse, however, is no protection against the heat developed at bad joints or at points where leakage from one wire to another (or to some other conducting medium) is localized. It prevents an excessive flow merely, not a flow along unauthorized paths or over improper obstructions.

And yet heavy copper or iron wire is not infrequently used to replace these fuses, thus defeating the object of the device; and, indeed, cases are on record where the brass-capped fuse plugs were filled solid with lead, in order, as the engineer expressed it, "to do away with the only weak part of the system!"

When a fuse "blows" it invariably scatters molten metal, which may communicate a dangerous degree of heat to the material upon which it falls; and yet very many people fail to understand why the inspector requires that the fusing appliance shall be inclosed in a non-combustible case.

The only protection against poor joints lies in the prevention of them.

The best protection against local leakage consists in the adoption of a good insulating covering for the wires and of such a method of construction as would permit of the operation of the circuits without leakage if the wires were entirely uncovered, in which case the insulation becomes an efficient factor of safety. The first general suggestion which appears in the rules of the National Board of Fire Underwriters of the United States reads as follows:

"In all electric work, conductors, however well insulated, should always be treated as bare, to the end that under no conditions existing, or likely to exist, can a grounding or short circuit occur, and so that all leakage from conductor to conductor, or between conductor and ground, may be reduced to a minimum."

"Grounding" is the development of a possible path from one wire to some foreign conducting medium, as, for example, a gas pipe or a metal ceiling; a "short circuit" is a path from one wire to another. Upon this fundamental suggestion by far the greater part of the rules of the above Board are based.

An acquaintance of the writer, practiced in the designing of appliances electrical, is fond of characterizing each invention as it comes out as "fool-proof;" and the dominant thought which guides his labors is to so construct his devices that the misuse of them entails more labor than does their proper operation. So it is with the electric wiring rules; they are intended to render the whole construction "fool-proof." Many a provision in them which seems altogether useless at first blush, has been inserted with a view to guarding against the repetition of accidents which have actually happened; and, if we accept the general intent of the rules, we must perforce agree to observe their detailed requirements.

A New Pneumatic Yoke Riveter.

Iron Age reports that the Pneumatic Tool Company, of Philadelphia, has designed a pneumatic yoke riveter adapted to a wide range of work on tanks, bridges, ship frames, structural work, etc. It will drive rivets of any size up to 1⅛ inch and may be used with a depth of yoke varying from 10 inches to 10 feet or more. This riveter presents a number of improvements in design. It is positive in its action, no dependence being placed on springs or other similar devices. The entire action of the machine is under the control of the operator, by means of 1 throttle lever. The first movement of the lever causes the hammer cylinder to move out against the rivet, the next movement starts the hammer to work on the rivet. When the rivet head is completed a reverse movement of the lever causes the hammer to stop working and the cylinder to withdraw into the casing by air pressure. The advantage of this arrangement is that the cylinder may be moved out until the button set comes in contact with the hot rivet and is held there while any necessary adjustments are made before starting the hammer to work. This will, in many cases, prevent spoiling the rivet. The withdrawal of the cylinder into its casing by means of air pressure enables the operator to use the machine in any position with the certainty that the cylinder will positively remain inside the casing until he is ready to drive the next rivet. These points will be appreciated by those who have used other types of yoke riveters. The smallest yokes are usually made of flat bar iron bent around to suit; medium size yokes up to 48 inches deep are made of extra heavy wrought iron pipe, while those of greater depth are made of steel plates braced and stiffened with angle iron. The machine is light in weight and simple in construction, having but three moving parts. With each machine are furnished 2 riveter dies and 1 holder on die with the necessary collars for adjusting the gap for different lengths of rivets. The machine requires 25 cubic feet of free air per minute for its operation and ample facilities are provided for thoroughly oiling all parts. On field work, erecting large water, gas and oil tanks, 80 to 100 rivets per hour have been driven.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, Jan. 10, 1900.

The New Century—A Weak Spot in English Gas Enterprise—The Floods.

Your readers are probably tired of being told that they have just witnessed an event that will not occur again in their lifetime. An irascible old gentleman, being accosted by a jovial neighbor with the salutation of, "It is a beautiful morning," fiercely replied "And who said it wasn't?" and during the last few weeks we have heard so much about the dawn of the new century, that one might almost be pardoned for asking if anyone had asserted that new centuries came every few years, or that the average man expected to see a number of them. Perhaps he need not entirely deplore if he does not, for the new century has been preached in and out of season—usually out—and one can scarcely take up a newspaper or a periodical without finding this event referred to in more or less unnecessarily lengthy language, and with accompaniments of a more or less hackneyed character. Some of your humorists used to remark, with reference to persons who posed as important workers in the interests of humanity, that they would be better employed in tilling the soil, and the same will apply to the century sensationalists who rake up statistics as to how many pills were consumed in the first and last year of the century respectively, or the prices of corkscrews in the same period. The progress, religious, social, mental and physical, of the human race during the last ten decades is a good theme, and one that has been handled in many cases with marked ability. But very few writers, in dealing with technical progress, have put our own industry in a proper position; and after all that has been written there is room for a review of gas manufacture and supply, which is not in the least of the modern innovations that have come into use in the interval of time between 1801 and 1900. Our technical press has not been deficient. It has done full justice to the subject from an inside point of view. Indeed, it has done more than one might expect, but I need not attempt to deal with that topic here, as no doubt the same will receive attention in other columns of your paper. But I am referring now to an outside view, not a *resumé* of the technical advancements that are dear to the gas engineer, nor to the probabilities of future dividends that arouse the interest of a capitalist, but to the social aspect of the gas industry as connected with the life of the nation; such as the number of men engaged in it and the salaries earned, the subsidiary industries it has been the means of bringing into existence, and so on. But even more important than this is the change in industrial conditions that have followed in the wake of the gas burner. Not until the gas was laid on did it become possible to work two shifts a day on expensive machinery, practically doubling the output from a given investment of capital, and enabling large orders to be filled in a short time. The lighting of our streets and thoroughfares in such a manner that the policeman can recognize his customer by night as well as by day, has not only stopped the horseplay of mischievous youths, but has practically put an end to burglary and highway robbery, and caused the blunderbuss and spring rattle, once considered indispensable in every household, to become relics of the past. The steady and regular supply of gas has an intimate association with the multitudinous details and processes which enable the daily newspaper, containing news up to the small and early hours of the previous night, to be laid on the breakfast table at 8 A. M. The enormous amount of night traffic that is now common to our principal lines of railway, only came within the regions of practicability when the stations and luggage yards could be lighted by gas. It is an admitted fact that the use of gas ranges has helped largely in reducing the fog nuisance in the metropolis and other large towns. Many of our technical industries are entirely dependent upon the steady, constant and easily adjustable degree of heat that can only be obtained by the agency of coal gas. Gas is not only a home industry, involving no international questions so far as its main features are concerned, but it is a local industry employing local labor, and especially offering work at the winter season of the year, when ordinary outdoor employment is greatly reduced. One is naturally inclined to think that his own geese are swans, and perhaps, therefore, I am overdoing the importance of the gas industry, but yet cannot avoid the impression that some of the headings above given are of more importance from a public point of view, and might have been treated with more acceptation than much of the matter that goes to make up the average "centennary review." Returning to our special technical reviews, there is a general consensus of opinion that the weak place in the English gas industry is the commercial department. Progress has been made in methods of processes of carbonizing, purifying and distributing, but although something has been done towards educating the consumer, the public have been left, to a great extent, to find out the advantages of gas for themselves. At any rate, inadequate presentment has been brought forward by the suppliers. In many lines of business, the selling department is the most important. There is not merely the desire to mark time, or to keep the ball rolling, but to develop the capabilities of the commodity to the utmost. Canvassers and travellers are sent out to every town, county or country where business is likely to be obtained. A sum amounting to a respectable percentage in the total profits is spent in direct and indirect advertising. Notwithstanding the absence of these advantages the sales of gas have more than doubled within the last twenty years. And if this is the case where 90 per cent. of the gas companies have never solicited an order or issued a circular, what would be the increase, if a staff of canvassers had beaten out the district, calling on every householder, ascertained objections and the reasons why gas was not used, and been followed up by a wise and liberal administration carefully laid out to meet all requirements that possibly can be met by enterprise and ability. The reason of the neglect of this important department is very obvious. English gas directorss as a rule, think it their duty to look sharply after the staff, and to keep the item of salaries down to the lowest possible limit.

A job that is going to be done some day is usually never done at all, and a staff of inspectors and clerks barely adequate to tackle the everyday operations have neither time nor opportunity to give anything like adequate attention to the selling department. They do not, of course, neglect any opening for influencing business that chance may put in their way, but that is a very different thing from a systematic plan of campaign. The bill cannot be properly filled by spasmodic efforts put forth between whiles and at quiet times. No one thinks of leaving any important department to be a stoppage for spare moments. What would be thought of a suggestion to leave the collection of the accounts for a clerk or inspector to do in the intervals of his own proper employment? Yet this is the position allotted by tacit consent to the commercial side of the gas industry. Let us hope that the remarks on this subject will not pass unheeded, and that the directors of gas undertakings will not rest satisfied with the bare husk of a normal 5 per cent. increase, or anything short of adequate effort

for the proper expansion of their business. This cannot be secured without some addition to the present staff, and assuming such addition to be made there must be some patience as regards results. The seed sown by a more active and aggressive policy must be allowed a sufficient time for taking root and fructifying, and it is no use to look for immediate returns.

Many persons residing in the Midland and Southwest of England will have reason to remember the closing days of what we are already beginning to call the old century, which were attended with high winds and heavy rain. In some towns the gas works were flooded, and the retort house furnaces extinguished, and in one or two places the supply of gas was entirely stopped for some hours. Fortunately the Christmas recess and the mild weather previous to the event, enabled the majority to face the trouble with full holders. Vaults or cellars of regenerator furnaces were the worst sufferers, as they were soon filled up to charging floor level and rendered useless until fire engines had been requisitioned for the purpose of clearing them. This point should not escape attention when erecting furnaces in localities liable to flood. If the furnace is at ground level it is at once available after the natural subsidence of the deluge, but the clearing of a cellar or vault is a matter that may occupy not only hours, but days. At the Aylestone Road Gas Works, Leicester, a retort house of three million per day productive power was disabled for some days from this cause. With an adjoining house of four million capacity, Mr. Colson and his staff were more fortunate, and by dint of strenuous efforts and excellent arrangements managed to keep their flag flying. At Coventry the regenerator furnace pits and also several of the gas mains were flooded. At Warwick the works were flooded, and the supply of gas stopped by the outlet pipes from the holders becoming waterlogged. Frome and Alcester were without gas for several hours. But on the whole it is remarkable that the supply of electricity suffered much more than that of gas, and it is not easy to explain why this should be. Of course the flooding of the boiler flues or the engine room is as effective in stopping the supply of electricity as the sealing of a gas holder outlet in regard to the supply of gas, and electricity does not enjoy the advantage of a 24 or 30 hours' storage. But while there are special reasons for keeping the gas works in a low level locality, there is nothing of a similar nature in regard to electricity. On account of economy in construction the electricity generating house is usually arranged with a basement floor, in which switchboards and other important machinery may be located, and when both gas and electricity supply are under the control of the local authorities the whole of the works may be kept to one site. In other instances the works are located on the banks of a river or canal in order to get the benefit of water carriage of coal. But this does not explain why electrical engineers should show a preference for low levels. They have no unsightly objects such as lower scrubbers and gasholders. The chimney stack is the only part that is difficult to dispose of with full consideration for æsthetic tastes. The man who can design a fine art chimney stack has yet to be born.

Unfortunately for those whose producing capacity was reduced and holders run down by the effects of the flood, severe frost and snow followed within a few days, thus causing a large increase in the demand for gas, and throwing an additional strain upon them at a time when they are not in full fighting trim. Such are the vagaries of the English climate. Within the last fortnight we have experienced a violent southwesterly wind accompanied by the heavy rain that is responsible for the troubles just mentioned, the usual northeaster two days afterwards, a day or two of heavy fogs, then clear frost, heavy snow storms, and a thaw that cleared off every vestige of snow within 24 hours. Do you wonder that Englishmen are always talking about the weather?

ITEMS OF INTEREST FROM VARIOUS LOCALITIES

AT the annual meeting of the Rockville (Conn.) Gas and Electric Company the Directors elected were: Messrs. A. M. Young, F. W. Marsh and G. E. Terry. Mr. M. Timmons Walker continues as the Company's General Manager.

IN our mention last week that the works of the Long Beach (Cal.) Gas Company had been put into successful operation we omitted to report that the Low process installed there was constructed by the Western Gas Construction Company, of Fort Wayne, Ind.

A CORRESPONDENT in Philadelphia informs us that through a woman's wit the gas works at Hollidaysburg, Pa., are, and will hereafter, or "until further notice," be operated by a woman. The present operator of the plant is Miss J. Gussie Ditting. The account forwarded by our correspondent, respecting the accession of Miss Ditting to the ownership of the works aforesaid, looks a little bit out of line in that the output of the plant per annum is put at 60,000,600 cubic feet. Perhaps the press writer meant 6,000,000. Miss Ditting has been in control of the plant for something over two years.

A CORRESPONDENT forwards the following, from Des Moines, Iowa, under date of Jan. 16th: "Yesterday. Mr. William B. Keffer, Secretary of the Capital City Gas Light Company, of Des Moines, Iowa, paid into the city treasury $1,667.60, which sum represented 2 per cent. of $88,380.17, the gross receipts of the Company from gas sales during the 6 months ending December 31, 1900. For the preceding 6 months the sum paid on like account was $1,626.51. Consequently the City's receipt on this account for the year was $3,294 11. In the last 4 years the city's receipts from the sales of gas by the Capital City Company have virtually reached the sum of $12,000, while at the same time the residents of Des Moines have enjoyed the use of gas at a cost of $1.20 per 1,000 cubic feet, as compared with a charge of $1.70 per 1,000 cubic feet in 1897. This result shows that a graded schedule over a period of years, the decrease in price to follow an increased annual consumption, is pretty close to the fair policy that should be maintained respecting corporate authority, consumer and Company. I should have remarked that meanwhile the Company has kept its plant, particularly in the instance of its distributing division, right up to date."

NEGOTIATIONS are underway looking to the consolidation of the gas and electric lighting interests of Newton, N. J. It seems needless to say it, but it may be worth repeating that the whale is the Gas Company.

THE Municipal Gas Company, of Albany, N. Y., has declared a quarterly dividend of 2½ per cent., payable February 1st. How about cheaper gas for Albany?

AT the annual meeting of the shareholders in the consolidated gas interests of Springfield, Ohio, the officers chosen were: Directors, W. K. Brice, F. E. Randall, H. L. Brice, A. S. Bushnell and E. W. Hanley; President, A. S. Bushnell; Vice President, W. K. Brice; Secretary and Treasurer, E. W. Hanley.

THE Lawrence (Mass.) Gas Company will go on with the supply of gas to the residents of the adjoining town of Andover forthwith. Agent Humphreys deserves much credit for his course in this matter, the negotiations for the rights having been conducted in a way that provoked no particular friction.

THE proprietors of the Waynesboro (Pa.) Gas Company will make important plant extensions the coming spring. The scheme includes a new storage holder, a vessel that the Company sorely needs.

AT the annual meeting of the Equitable Gas and Electric Company, of Utica, N. Y., the officers chosen were: Directors, William T. Baker, Chas. S. Symonds, E. A. Pinkney, A. N. Brady, N. F. Brady, W. H. Bailey, Thos. C. Murray, Henry J. Hemens, H. J. Grant and H. W. Olcott. President, A. M. Brady; Vice President, H. J. Grant; Secretary, H. W. Olcott; Treasurer and General Manager, E. A. Pinkney. It is likely that the Company will soon construct an electric lighting plant that will be equal to any demands made upon it by the residents of Utica and the nearby villages.

IT is said that the proprietors of the Tonawanda (N. Y.) Gas Light Company propose to raise the price of illuminating gas to $1.80 per 1,000 cubic feet, the increase to date from the 1st prox.

MAYOR HINCHCLIFFE, of Paterson, N. J., has vetoed the ordinance under which the sponsors of the North Jersey Gas Company proposed to engage in the supply of gas in Paterson and adjoining places.

AN application has been made to the General Assembly of Connecticut for the right to supply gas and electricity in the towns of Stonington, North Stonington, Groton and Ledyard, by the projectors of the Peoples Light and Power Company, of Stonington.

THE Board of Gas and Electric Light Commissioners of Massachusetts recently forwarded the following communication to the Gov-

ernor, who in turn transmitted it to the Legislature—it has to do with the proposed consolidation of the electric lighting interests of Boston:

"Dear Sir: We beg to call your attention to a proposition now pending before the shareholders of the Boston Electric Light Company and the Edison Electric Illuminating Company, of Boston, corporations organized under the laws of this Commonwealth, and engaged in the supply of electric light, power and heat in the city of Boston for the leasing of both corporations for a long term of years to a third organization. By the terms of the proposed lease the new organization is to guarantee annual dividends of 10 per cent. upon the stock of the first named Company and 11½ per cent. upon the stock of the second during the life of the lease and is to issue at par new capital stock to the amount of not less than $3,600,000 or about 50 per cent. of the outstanding stock of the two existing companies. We respectfully suggest that such an arrangement appears to be in violation of the policy of the Commonwealth as declared in the well known anti-stock watering laws, and has a tendency to seriously embarass, and perhaps wholly defeat the application to these corporations of that wholesome restraint, in the public interest, which is clearly intended by present statutes. No authority exists in this Board, so far as we are advised, to prevent or in any way control a combination of this character without additional legislation. The Board, therefore, requests that you call the attention of the legislature to the condition of affairs herein described, for such action as that body may deem it advisable to take. This representation is made at this time to avoid the delay incident to the Board's annual report, which the law requires to be made in print."

A CLIQUE entitled "Forrest Adair & Associates," applied some days ago, to the City Council of Atlanta, Ga., for the right to operate a gas works in Atlanta, Ga. The legal spirit in the Adair order of forrestry seems to have been Mr. Burton Smith, who signs himself as attorney for the petitioners, to the following petition: "Hon. Mayor and General Council, City of Atlanta: The petition of Forrest Adair respectfully shows that he desires permission for himself and his associates to lay gas mains and pipes in the city of Atlanta, including the privilege of making all necessary connections with consumers, and with a plant to be erected for the manufacture of gas. Your petitioner asks that this petition be granted, subject to existing laws and ordinances in force in the city of Atlanta and subject to the same rules and regulations as apply to the Company now doing business in Atlanta." Forrest Adair and his associates seem to be actuated by the motives that impelled the daring foresters of olden times. Meanwhile it looks that there will not be much doing on their particular side in Atlanta, for the city has a Mayor who respects the rights of those that have, in their corporate functions, kept faith with the authority which guaranteed them ownership until such time as the owners failed to respect their obligations.

MESSRS. JOHN C. DUNTON, of Grand Rapids, Mich., and W. R. English, of Cleveland, Ohio, have applied to the authorities of Holland, Mich., for the right to establish and operate a gas works there.

THE proprietors of the Louisville (Ky.) Gas Company have declared a semi-annual dividend of 2½ per cent.

AT the annual meeting of the proprietors of the Houston (Texas) Gas Light Company the officers chosen were: Directors, T. W. House, T. H. Scanlan, H. S. Fox, James A. Baker and John H. B. House; President, T. W. House; Vice-President, T. H. Scanlon; Secretary, Treas. and Gen. Manager, John Shearn; Superintendent, J. H. Fitzgerald.

PEOPLE prominent in the management of the United Gas Improvement Company, positively deny that the Company has any intention of taking over, for operating account, the properties of the local (or Philadelphia) electric lighting concerns.

IT may be a trifle late in the festive season to announce it, but a leading feature of the Christmas edition of the Buffalo (N.Y.) *Courier* was a handsomely colored page, devoted to an exposing and expounding of the value and cheapness of gas as an illuminating, cooking and heating agent. The Buffalo Gas Company was the advertiser, of course; and Secretary and Treasurer Riselay, made no mistake in getting up the "ad." It was artistic, and it must have been effective.

AT the annual meeting of the Jacksonville (Ills.) Gas Light and Coke Company, the officers chosen were: Directors, J. Weir Elliott, Wm. Routt, Frank Elliott, Robt. Hockenhull, J. A. Bellati, W. E. Veitch and F. M. Doan; President, Frank Elliott; Vice-President, R. Hockenhull; Secretary, F. M. Doan; Treasurer, J. A. Bellati; Auditor, W. E. Veitch; Superintendent, F. M. Doan; Asst. Supt., J. Parker Doan.

A CORRESPONDENT in Boston, Mass., forwards the following details respecting the rate card issued by the proprietors of the Spencer (Mass.) Gas Company, detailing the sales' practice established by the Company since the 1st inst.: For lighting use, $2 per 1,000 cubic feet gross, with 25 cents off per 1,000, if paid before the 20th of the month; for cooking and heating, $1.50 per 1,000 cubic feet gross, with 10 cents off per 1,000; for lighting and cooking through one meter, October to April at lighting rate; April to October at cooking rate. The Company will insist that no bill shall be less 25 cents per month. The Company sells gas appliances of all sorts at net cost to itself.

BROTHER DEAN, Secretary of the Owosso (Mich.) Gas Light Company, is having some trouble with the authorities over the adjustment of gas rates in that sleepy Michigan borough—that is, the borough was sleepy enough until the Company enabled some of the residents, through the means of a good supply of light, to see each other's faces after 5 P.M. during the winter's spell. In 1887 the Company was chartered, and its works were built, we believe, in the same year. In any event, not much time elapsed between the chartering and the constructing. The ordinance permitted the Company (and does still permit it) to charge $2 per 1,000 cubic feet for a period of 30 years. But Mr. Dean and his associates saw fit to cut the legal rate of their own volition from time to time, until they got to a net selling price of $1.30 per 1,000, which price now prevails. The authorities want gas at $1 per 1,000. Under the circumstances the Owosso Company would seem justified in putting the price to $1 50. The output at Owosso is quite a bit under ten millions cubic feet per annum.

MR. EDGERLY, of Somersworth, N. H., is sponsor for an appeal to the New Hampshire Legislature for an act to permit the absorption of the properties of the Dover Gas Light Company and of the Berwick Power Company by the United Gas and Electric Company, of Dover.

AT the annual meeting of the Newport (R. I.) Gas Light Company the officers chosen were: Directors, A. K. Quinn, Frederick Tompkins, Melville Bull, Henry Bull, Jr., and Thomas A. Lawton; President, Melville Bull; Treasurer and General Manager, Andrew K. Quinn; Secretary, Thomas A. Lawton.

MR. A. L. FENNESSY'S Counsel, who, in this particular instance, seems to have been Mr. Ernest Wallace, has withdrawn his application to the Town Board of Rockville Center, L. I., for the right to supply gas in that place. The Brooklyn *Times*, of the 17th inst., referring to this request of Mr. Fennessy, said, among other things: "Mr. Fennessy's application stated that he could furnish gas at a maximum rate of $1.50 per 1,000 cubic feet, but if the Board wished it his Counsel said he would raise the maximum rate to $2 per 1,000 cubic feet." There's liberality, if nothing else. Rockville Center, we believe, "Owns and operates a municipal electric lighting plant."

AT the annual meeting of the Lexington (Ky.) Gas Company the officers chosen were: Directors, J. R. Morton, T. D. Mitchell, A. B. Lancaster, Louis des Cognets, E. L. Hutchinson and A. S. Winston; President, A. S. Winston; Secretary and Treasurer, Henry Hutchinson. A semi annual dividend of 2½ per cent. was declared.

THE attempt to force the Laclede Gas Light Company, of St. Louis, Mo., to supply a gas of 25-candle power has failed. The Committee of Public Improvements, who considered the proposition, reported that 20-candle power was ample. And so it is.

MESSRS. FRAZIER BROTHERS, of Bloomington, Ind., are desirous of obtaining the right to operate a gas works in Bedford, Ind.

AT the annual meeting of the Gas Company of Luzerne county, Pa., the officers chosen were: Directors, A. Nesbitt, J. W. Hollenback, E. W. Mulligan, L. A. Stearns, Liddon Flick, E. H. Jones, E. C. Jones, Jno. Flanigan and E. C. Stegmaier; President, Abram Nesbitt; Vice-President, J. W. Hollenback; Secretary and Treasurer, E. Mulligan.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

MONDAY, JANUARY 28, 1901.

The Market for Gas Securities.

The city gas share market was very unsettled during the week. Consolidated sold down to 187, but did not remain long at that figure, a quick and rather unreasonable spurt to-day (Friday) sending it beyond 194. The closing was made at 192 to 193. The annual meeting was harmonious, the only change in the Directorate being the naming of Mr. Frank Tilford to replace Mr. Auchincloss. President Gawtrey admitted that the output for the year had been well over 16,000 millions cubic feet. He also remarked that the electric lighting end of its trading was doing nicely. The stock is very cheap at the quoted figures. City gas bonds continue in good demand.

Brooklyn Union is well held; Peoples, of Chicago, is about as before, and Baltimore Consolidated is a trifle weaker. Mr. C. H. Dickey will shortly be elected Vice President of the Baltimore concern. Bay State is returned at "one" bid, and Washington (D.C.) has gone back to 310. Lacledes are not in great favor just now, but they are good enough to buy at the quoted rates.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JANUARY 28.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$54,595,200	100	192	193
Central Union, Bonds, 5's.	3,000,000	1,000	108½	109½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	120	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	295	299
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	..
New Amsterdam Gas Co.. Bonds, 5's	11,000,000	1,000	109¼	110
Northern Union, Bonds, 5's.	1,250,000	1,000	104	104¼
New York and East River.. Bonds 1st 5's	3,500,000	1,000	106	106⅜
" 1st Con. 5's	1,500,000	..	115	.
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	131	133
Preferred	5,000,000	100	151	153
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	114
Yonkers	299,650	500	130	.
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	175	178
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	1	1⅛
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works..	450,000	100	29	35
" 1st Mtg. 5's	503,000	1,000	96½	99½
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	6	8
" " Bonds, 5's	5,250,000	1,000	68	71
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati G. & C. Co.	8,500,000	100	194	198
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	215	216
Consolidated, Baltimore	11,000,000	100	58½	59¼
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	12	16
" Con. Mtg. 5's	880,000	1,000	80	85
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,560,000	50	95	97
" Prior Lien 5's	4,737,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	100	101
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	35	40
Fort Wayne	2,000,000	..	35	41
" Bonds	2,000,000	..	60	64
Grand Rapids Gas Lt. Co..	1,000,000	50	100	105
" 1st Mtg. 5's	1,225,000	1,000	..	..
Hartford	750,000	25	240	250
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	..	45
" Bonds, 6's	2 650,000	..	93	95
Jackson Gas Co.	250,000	50	70	75
" 1st Mtg. 5's	265,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	101½	103
Laclede, St. Louis	8,271,000	100	72	74
Preferred	2,500,000	100	94	98
Bonds	10,000,000	1,000	108½	109
Lafayette Gas Co., Ind.	1,000,000	100	40	50
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co.	400,000	100	62	66
" 1st Mtg. 6's	350,000	1,000	102½	108
" 6 per cent. scrip, due 1901	100,000	25	87	89
Montreal, Canada	2,000,000	100	182	184¾
Newark, N. J., Con. Gas Co Bonds, 6's	6,000,000	..	..	55
New Haven	4,600,000	..	..	103
Nashville Gas Lt. Co.	1,000,000	25	280	300
Oakland, Cal.	1,000,000	50	110	..
" Bonds	2,000,000	..	46	47
Peoples G. L. & Coke Co., of Chicago	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	25,000,000	100	98⅞	99⅛
2d "	20,100,000	1,000	..	..
Rochester Gas & Elec. Co..	2,500,000	1,000	104	105
Preferred	2,150,000	50	88	..
Consolidated 5's	2,150,000	50	118	..
San Francisco, Cal.	2,000,000	..	87½	90
St. Paul Gas Light Co.	10,000,000	100	47¼	47½
1st Mortgage 6's	1,500,000	100	45	47
Extension, 6's	650,000	1,000	82	85
General Mortgage, 5's..	600,000	1,000	..	..
St. Joseph Gas Co.	2,465,000	1,000	88	90¼
" 1st Mtg. 5's	1,000,000	100	35	40
Syracuse, N. Y.	750,000	1,000	96½	98
Bonds	1,750,000	100	9	11
Washington, D. C	1,612 000	1,000	88½	93
First mortgage 6's	2,600,000	20	307½	312½
Western, Milwaukee	600,000	..	..	..
Bonds, 5's	4,000,000	100	97	99
Wilmington, Del.	3,830,500	..	107	107½
	600,000	50	200	201

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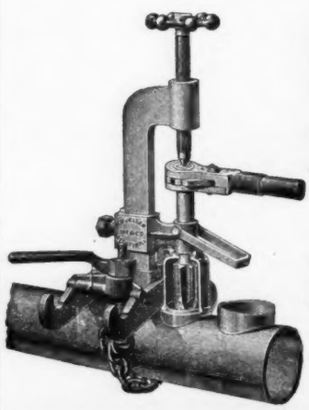

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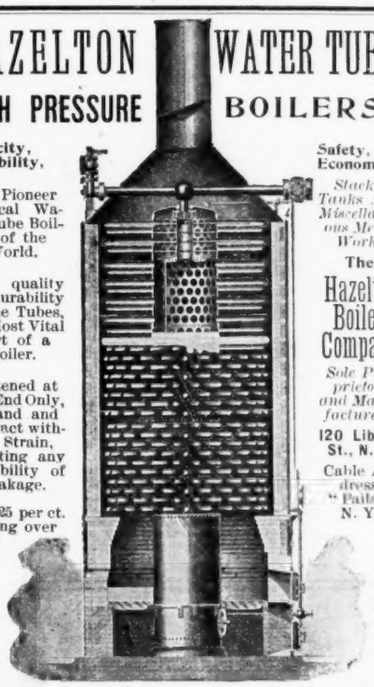

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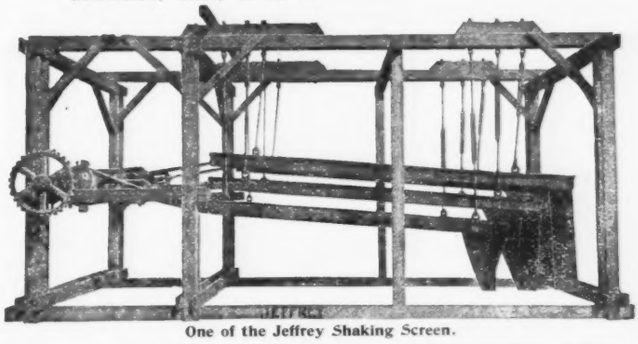

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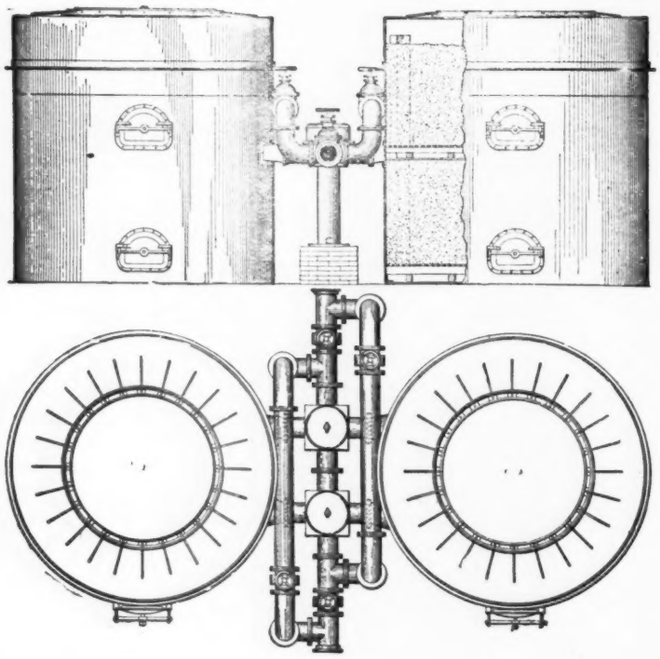

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Windsor Street Works, Birmingham, England (Second Contract)	2,000,000
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Leicester, England	2,000,000
Buenos Ayres (River Platte Co.)	700,000
Burnley, England	1,500,000
Kingston-on-Thames, England	1,750,000
Accrington, England	500,000
Tonbridge, England	300,000
Stretford, England	500,000
Oldbury, England	300,000
Saltley Works, Birmingham, England (Third Contract)	2,000,000
York, England (Second Contract)	750,000
Rochester, England (Second Contract)	500,000
Newport, Monmouth, England	250,000
Todmorden, England	500,000
Tokio, Japan	1,000,000
Nelson, British Columbia (Complete Gas Works).	

Sutherland Construction & Improvement Co.

Offices: 15 WALL ST., NEW YORK, and OSHKOSH, WISCONSIN.

Owners of the "SUTHERLAND" Patents for Water Gas Apparatus.

Gas, Electric Light, Water Works, and Electric Street Railways Built, Remodeled, Operated, Bought and Sold.

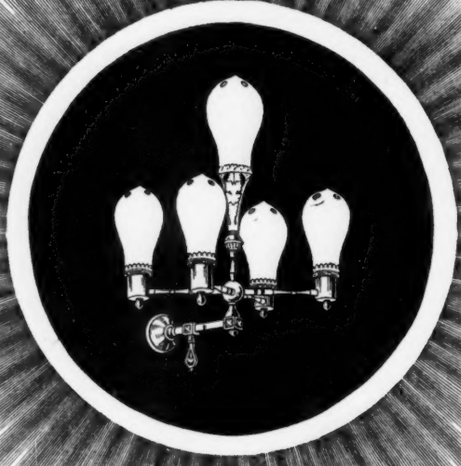
A few of the places where the SUTHERLAND Apparatus is in successful operation:

Ilion, N. Y.
Herkimer, N. Y., 2 orders.
Little Falls, N. Y.
Fishkill-on-Hudson, 2 orders.
Clifton Springs, N.Y., 2 orders.
Green Bay, Wis.
Stevens Point, Wis.
Tarrytown, N.Y., 3 orders.
Ft. Henry, N. Y.
Gainsville, Fla.
Hollidaysburg, Pa.
Waterville, N. Y.
Huntington, L. I.
Lexington, Mo.
Mendota, Ill.
Circleville, O.
Joplin, Mo.
Asheville, N. C.
Youngstown, O.
Kingston & Rondout, N.Y.

CORRESPONDENCE SOLICITED.

KERN

INCANDESCENT GAS LIGHT CO.



18 MURRAY ST.

NEW YORK.

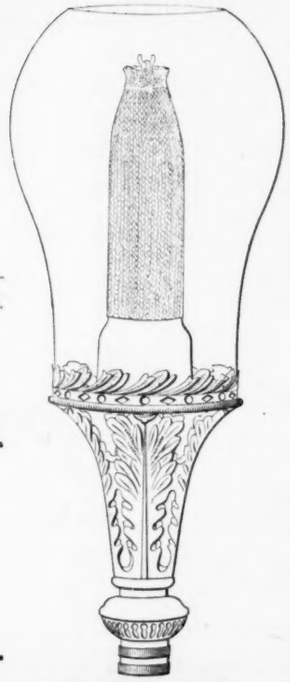
KERN INCANDESCENT GAS LIGHT COMPANY'S SYSTEMS.

SAVES 80 PER CENT. OF YOUR GAS BILL.

THE NEW DISCOVERY.
BURNS ONE CUBIC FOOT OF GAS PER HOUR.

No Chimneys to Break. Mantles do not Blacken. Better than Electricity, and only 1-10th the Cost. Not a mere statement, but a Guarantee.

CAN BE USED WITH { MANUFACTURED GAS. NON-CARBURETTED GAS. NATURAL GAS OR GASOLINE GAS.



35 TO 40 CANDLES PER CUBIC FOOT.

Burner No.	0	consumes	8-10	cubic foot,	30-candle	power.
"	1	"	1	"	35	"
"	2	"	2	cubic feet,	70	"
"	3	"	3	"	105	"
"	4	"	4	"	140	"
"	7	"	7	"	225	"

Prices Reasonable. Catalogues on Application. Agents Wanted.

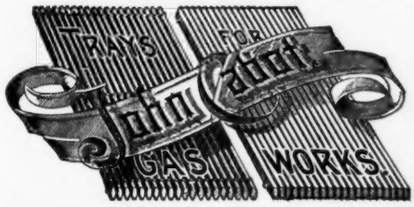
Kern Incandescent Gas Light Company, { 18 MURRAY ST., NEW YORK.

WE ARE THE ONLY MAKERS OF

Church's Patent Trays.

Reversible; Strongest; Most Durable; Most Easily Repaired.

Special Trays for Iron Sponge.



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We also Supply the Cheapest and Strongest

•Reversible Bolted Trays•

IN THE MARKET.

SEND FOR CIRCULARS.

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TROY, N. Y., U. S. A.

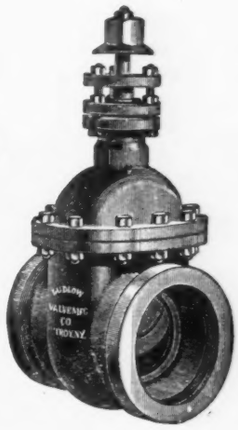
Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.



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PRESSURE GAUGE.

For continuous records of

Street Gas Pressure.

Simple in construction, accurate in operation, and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,

Waterbury, Conn.

Silver Medal, Paris Exposition.

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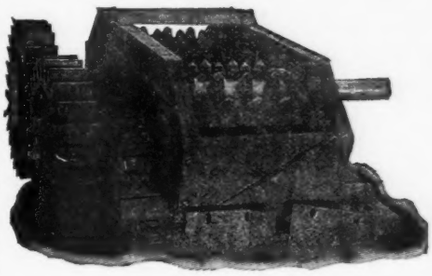
ENGINEERS, FOUNDERS, MACHINISTS,

Chicago, U. S. A.



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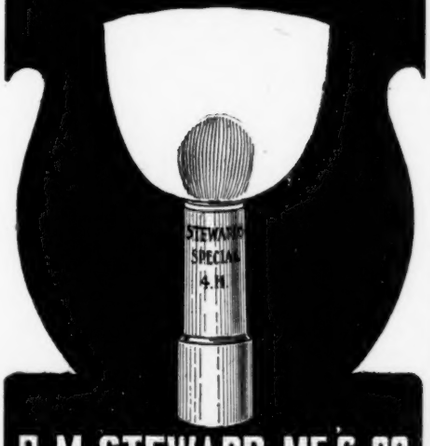
LINK-BELT ELEVATING & CONVEYING MACHINERY for HANDLING COAL, COKE, OXIDE, ETC.

Tilting Coal and Coke Cars, Breaker Rolls, Shaking Screens, Power Transmitting Machinery.

Machinery designed and erected to suit existing conditions and available space.

CATALOGUE UPON APPLICATION

A WELL SHAPED FLAME TO A GAS MAN IS AS REFRESHING AS A GLASS OF WINE TO THE LAYMAN



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THAT AN EVEN PRESSURE IS MAINTAINED AT ALL TIMES.

THE "VULCAN" GAS CONTROLLER

will do it.

For all kinds of gas, including acetylene.

No mercury or glycerine used.

The most simple, inexpensive and effective governor on the market.

Made in three sizes.

List Price, ¾-inch, $4.50; 1¼-inch, $5.50; 2-inch, $8.

Should be attached by Gas Companies to insure correct work and best results.

Every Controller guaranteed absolutely. Discount to the trade.

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WILLIAM M. CRANE COMPANY,

1131 AND 1133 BROADWAY, NEW YORK.

Parson's Steam Blower

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER.

FOR USING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER.

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

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Constructors of Coal Gas Apparatus.

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P. H. & F. M. ROOTS CO.'S
Exhausters, Governors, etc.

GENERAL AGENTS FOR

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AMERICAN GAS COMPANY,

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Coal and Water Gas Plants.

OWN SYSTEM.

RECUPERATIVE FURNACES, WASHERS, CONDENSERS, PURIFIERS, PURIFYING MACHINES, COKE CONVEYERS, ETC.

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Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas.

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LATEST IMPROVED GAS EXHAUSTER

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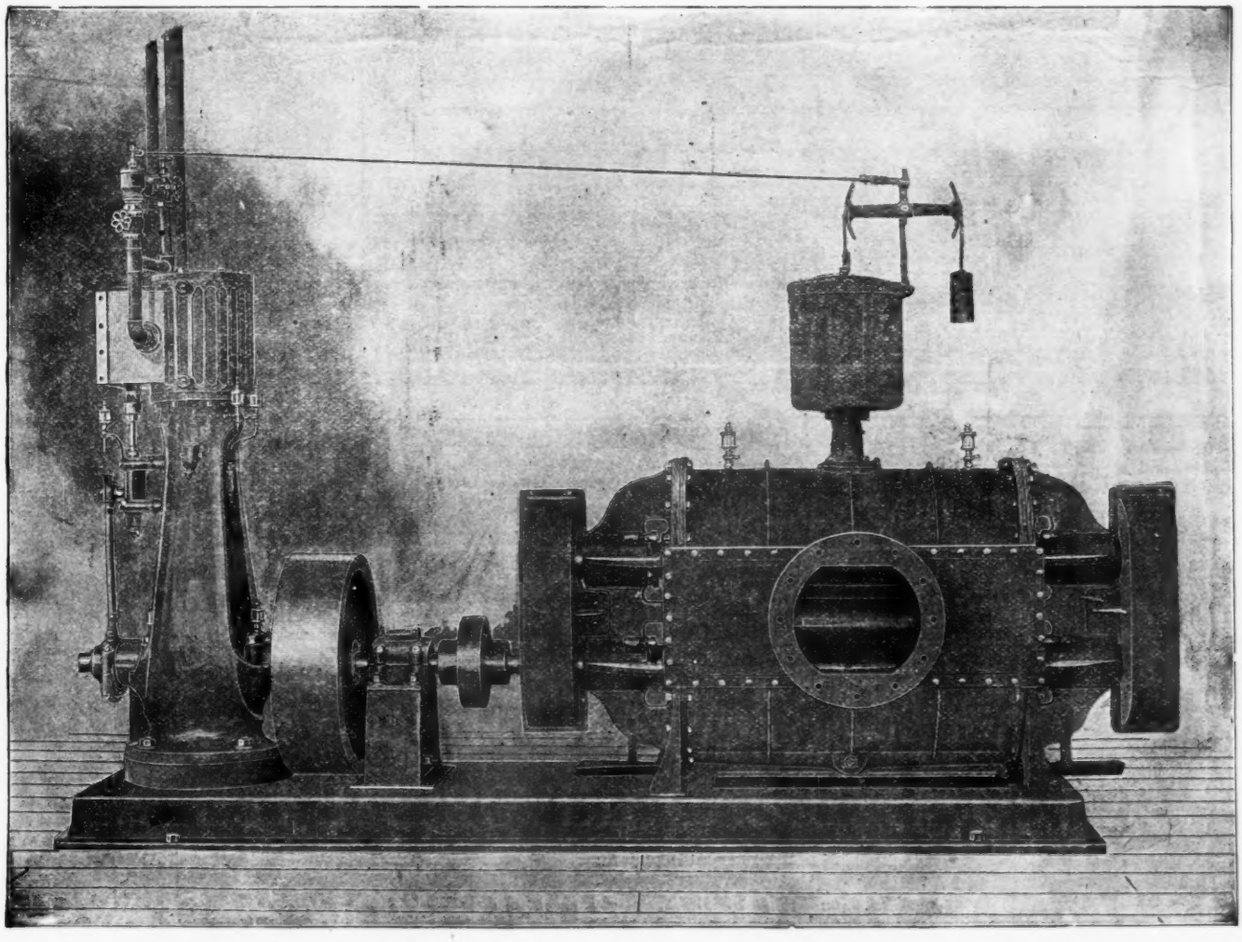
GUARANTEED TO REGULATE WITHIN ONE-TENTH OF AN INCH, WATER PRESSURE.

The Most Perfect Gas Governor on the Market.

MORE DIRECT IN ACTION. FEWER PARTS.
EASIER TO ADJUST THAN ANY OTHER GOVERNOR.



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Established 1856. Works at Phillipsburgh, N. J.

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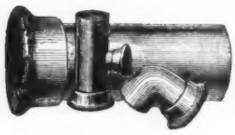

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

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STORAGE TANKS FOR GAS WORKS,

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PIPING IN AND AROUND GAS WORKS.

Work Done for Several of the Largest Gas Companies in America Stands as Reference.

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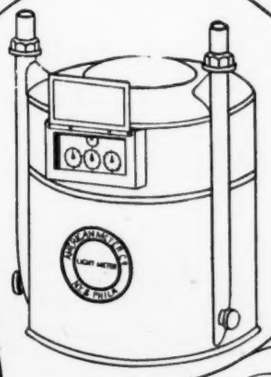

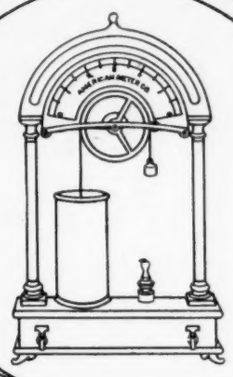

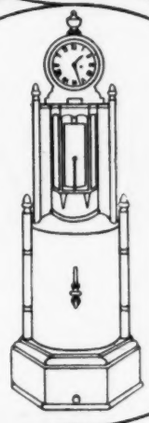

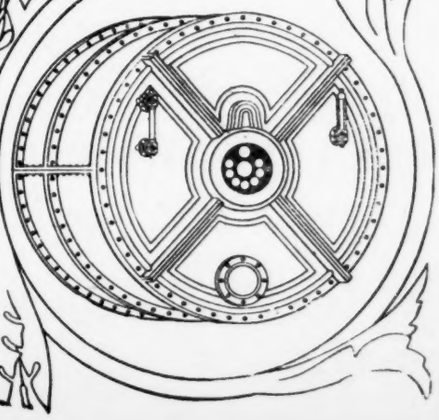

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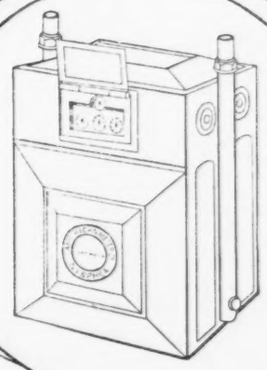
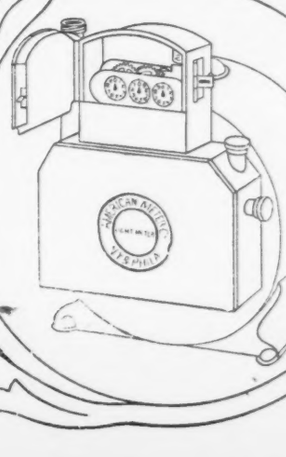




PUBLIC LIGHTING TABLE.

FEBRUARY, 1901.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Fri.	1	5.10 AM	6.10 AM	5.05	6.15
Sat.	2	No L.	No L.	5.05	6.15
Sun.	3	No L. FM	No L.	5.05	6.15
Mon.	4	No L.	No L.	5.05	6.15
Tue.	5	6.00 PM	8.50 PM	5.10	6.10
Wed.	6	6.00	9.40	5.10	6.10
Thu.	7	6.00	10.40	5.10	6.10
Fri.	8	6.00	11.40	5.10	6.10
Sat.	9	6.00	12.30 AM	5.10	6.10
Sun.	10	6.00	1.30	5.10	6.10
Mon.	11	6.00 LQ	2.30	5.10	6.10
Tue.	12	6.00	3.20	5.20	5.55
Wed.	13	6.00	4.10	5.20	5.55
Thu.	14	6.00	5.00	5.20	5.55
Fri.	15	6.00	5.50	5.20	5.55
Sat.	16	6.00	5.50	5.20	5.55
Sun.	17	6.10	5.50	5.20	5.55
Mon.	18	6.10 NM	5.50	5.20	5.55
Tue.	19	6.10	5.50	5.30	5.55
Wed.	20	6.10	5.50	5.30	5.55
Thu.	21	6.10	5.50	5.30	5.55
Fri.	22	6.10	5.50	5.30	5.55
Sat.	23	10.30	5.50	5.30	5.55
Sun.	24	11.40	5.40	5.30	5.55
Mon.	25	12.40 AM FQ	5.40	5.30	5.55
Tue.	26	1.40	5.40	5.30	5.45
Wed.	27	2.30	5.40	5.30	5.45
Thu.	28	3.10	5.40	5.30	5.45

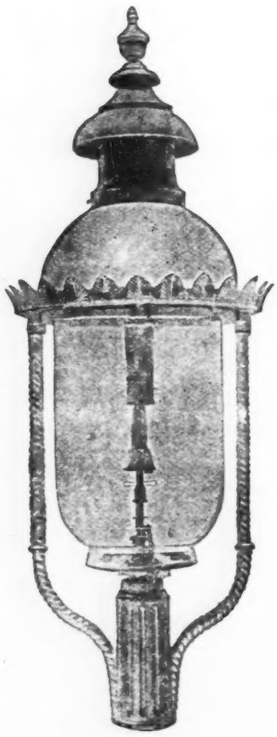
TOTAL HOURS LIGHTING DURING 1901.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	220.10	January	423.20
February	192.30	February	355.25
March	180.00	March	355.35
April	158.30	April	298.50
May	140.40	May	264.50
June	135.40	June	234.25
July	138.00	July	243.45
August	156.20	August	280.25
September	174.40	September	321.15
October	202.30	October	374.30
November	220.40	November	401.40
December	241.30	December	433.45
Total, yr.	2161.10	Total, yr.	3987.45

NEW YORK, 33 Nassau St. PHILADELPHIA, Broad and Arch Sts. CHICAGO, 54 Lake St.

Welsbach Street Lighting Company

.... OF AMERICA ....



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Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in seventy-five Cities and Towns.

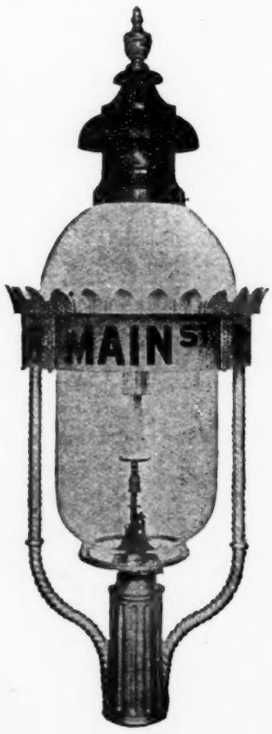
By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.



No. 38.

Correspondence solicited from Gas Companies and others interested in Municipal and outside lighting.

Welsbach Famous Mantles.

THE INCOMPARABLE

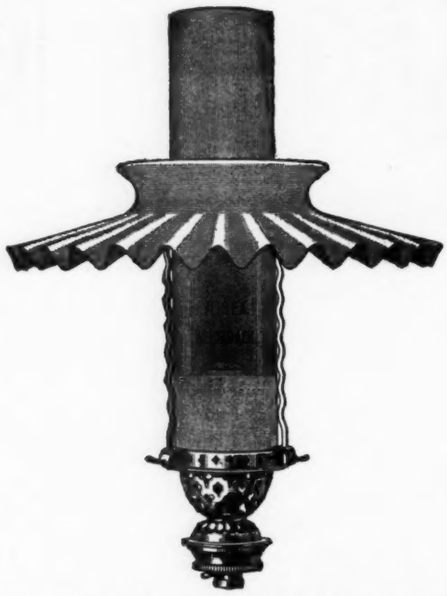
"Yusea" Welsbach Mantle

FINEST EXAMPLE

OF INCANDESCENT

GAS LIGHT

EVER EXHIBITED.



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—OF—

Magnificent Brilliancy

—AND—

Endurance.

THE HIGHEST ILLUMINATION,

The Lowest Cost.

Welsbach Lamps, Mantles, and Complete Line of Glassware and Supplies

WELSBACH COMPANY,

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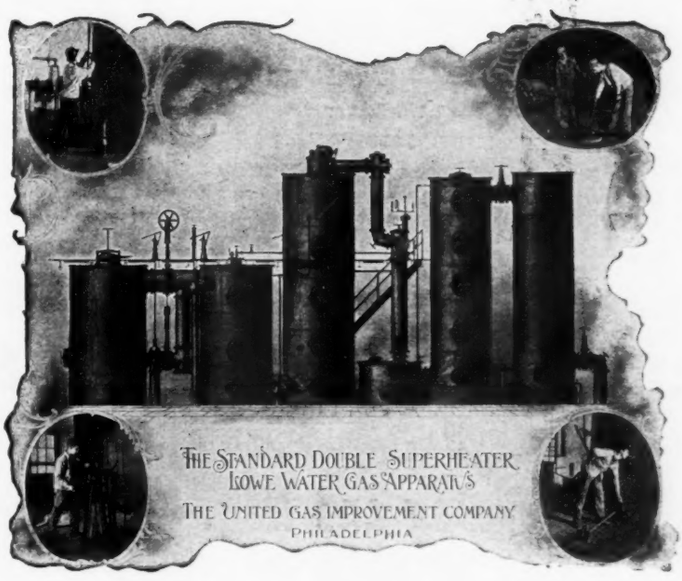
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LOWE WATER GAS APPARATUS
THE UNITED GAS IMPROVEMENT COMPANY
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H. D. ABERNETHY. Sec.

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Established 1854. Incorporated 1869.

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Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

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The Construction of Gas Works

PRACTICALLY DESCRIBED,

By WALTER RALPH HERRING.

Price $2. For Sale by

A. M. CALLENDER & CO.,

32 Pine Street, N. Y. City.

Adam Weber Sons,

Manhattan Fire Brick and Enameled Clay Retort Works.

Works, Weber, N. J.

Office, 633 East 15th St., New York.

Modern Recuperative Furnaces.

Standard Fire Brick and Gas Retorts.

Works,
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—ESTABLISHED 1864.—

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Successor to WILLIAM GARDNER & SON,

Fire Clay Goods for Gas Works.

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

HENRY MAURER & SON,

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WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,
BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

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In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
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For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,
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OAKHILL GAS RETORT & FIRE BRICK W'KS

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Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec.
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE RETORT & FIRE BRICK CO.

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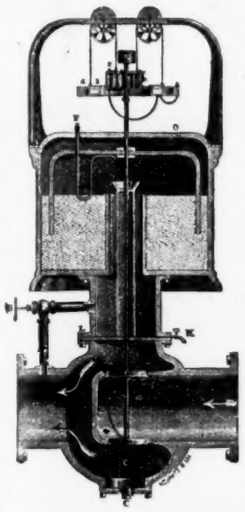

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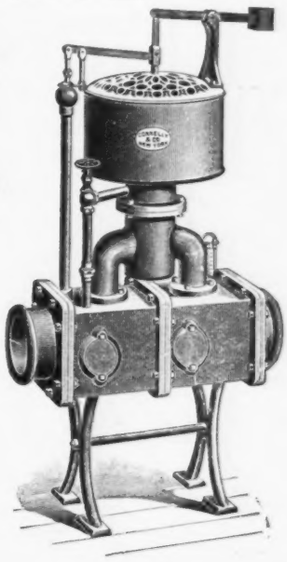

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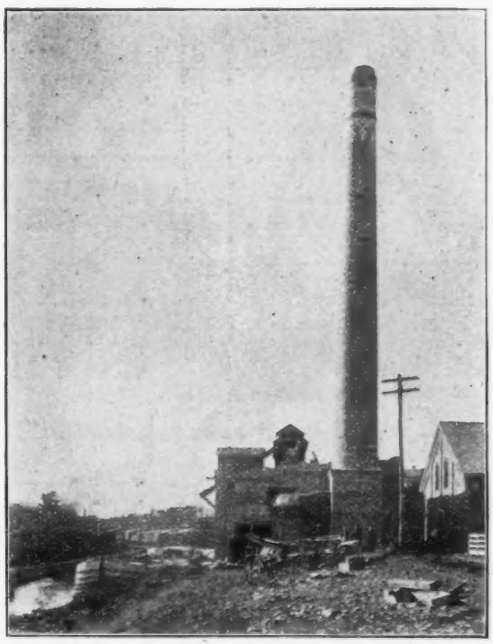

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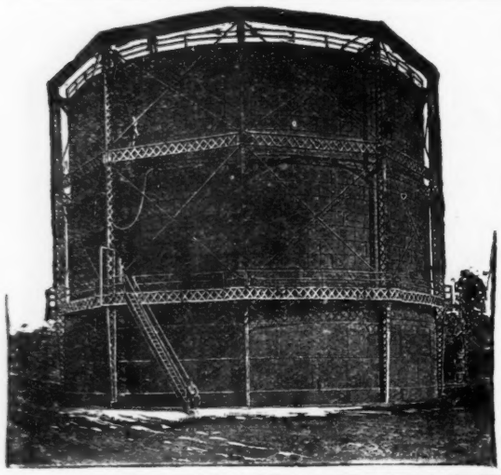

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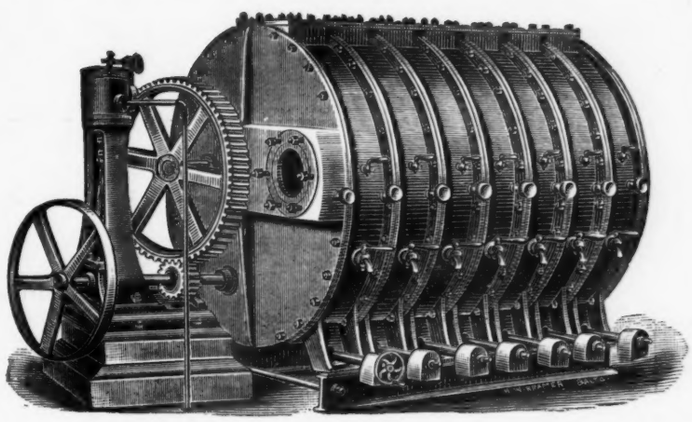

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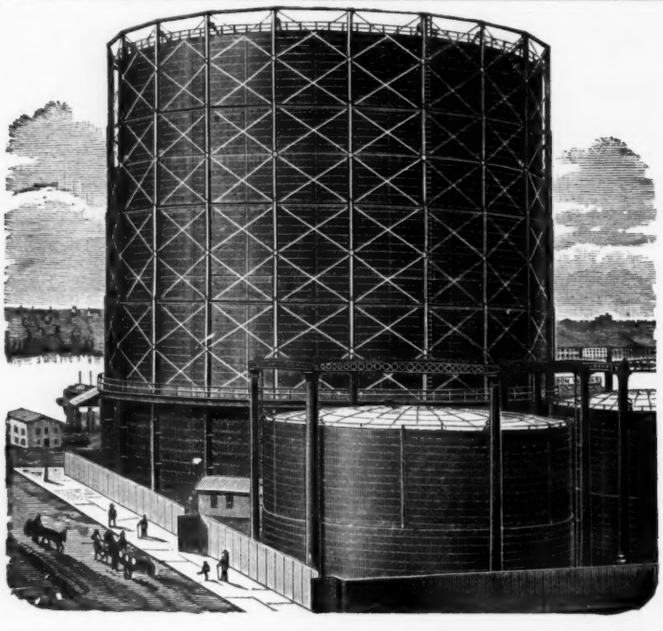

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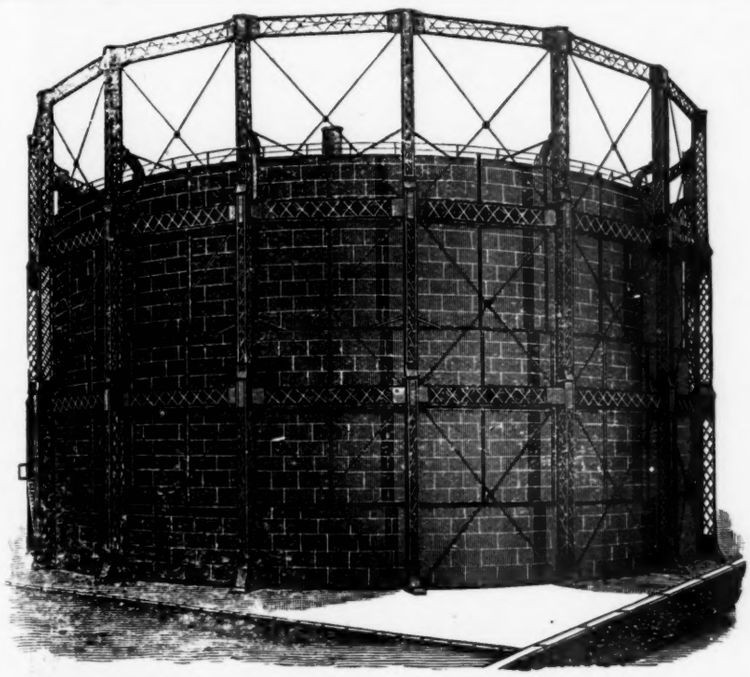

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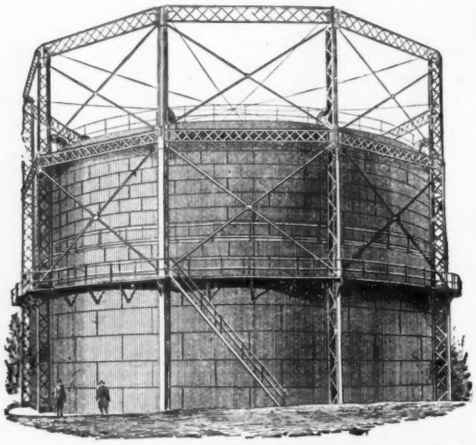

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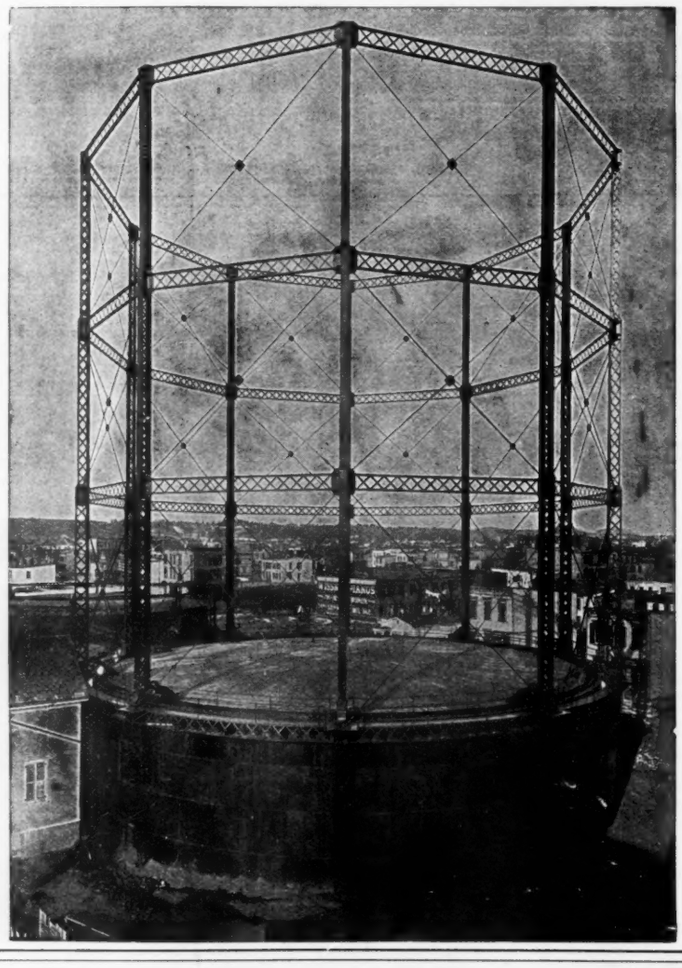

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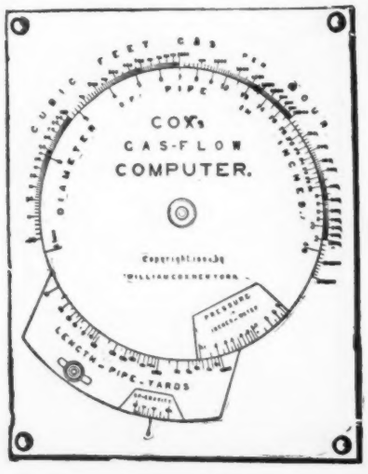

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